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James L. Keagy's

REPORT

OF THE

ENGINEER & GEOLOGIST,

IN RELATION TO THE

NEW MAP,

TO THE

EXECUTIVE OF MARYLAND.

ANNAPOLIS:
WILLIAM M'NEIR, PRINTER.

1836.

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ENGINEER'S REPORT.

To his Excellency

JAMES THOMAS,

Governor of Maryland:

IN the Report, which twelve months ago, the Undersigned, had the honor to lay before your Excellency, reference was made to several works of proposed internal improvement, which either had already engaged, or were expected during the season just past to occupy his care and attention. The local advantages and importance of these several works were thought by the Legislature, sufficient to warrant the immediate devotion of time which was otherwise to have been spent in the labors of the new map; and the Undersigned, in carrying into effect the resolutions, and prosecuting the surveys for the respective works, has spared neither personal toil, nor studious investigation, to ascertain and eliminate the facts and results which appeared proper to answer the objects and satisfy the interests of each.

In the report which follows, the order in which the execution of the surveys took place, will be preserved, and in the treatment of the subjects, the Undersigned, will call your attention to:

1. *The Cape Charles and Lewes Canal.*

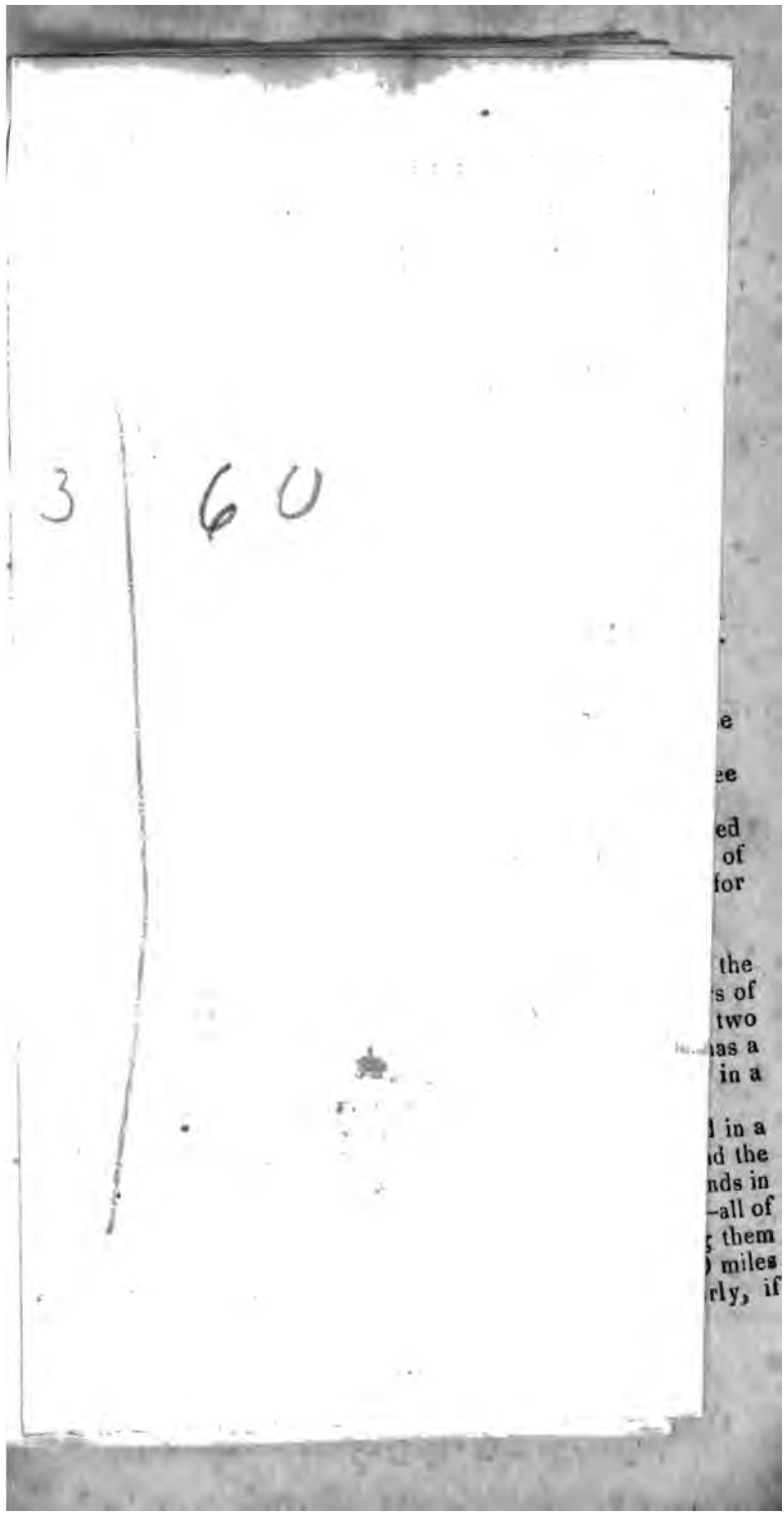
Although this work was undertaken and prosecuted by the Undersigned, under a separate authority, and therefore might appear to require a separate report under another character; yet in order to collect into one place all the facts relating to the History of Geographical details in Maryland, he has thought proper to introduce and conclude this subject here:—A report which, on the part of the Joint Board of Commissioners of the States of Delaware, Maryland, and Virginia, last year, was addressed to the Legislature of Maryland, contains all the facts and history in relation to this subject, which were in existence at the time of its being made; and in referring to that report, the Undersigned

believes, that he has saved himself the necessity of an capitulations. It will be sufficient to say, that in the pr cution of the objects of the commission, the proposed t gulation had been extended over a part of Virginia, an whole of the Atlantic coast of Maryland:—It has also laid out, and some preliminary observations made, ove Delaware Coast, and the Commissioners projected the pletion of the entire work, in all its details, in the seas 1835. The Legislature of Virginia, however, appear think the work sufficiently complete; at least, at its session, it passed a resolution instructing its Commissi to decline further co-operation. The Legislature of D ware, meanwhile, had granted a charter to a Compan corporated to carry into effect the plans which had projected by the Commissioners; but in the General As bly of Maryland, no definite action was had.

The Undersigned, who had spent in the work the v of a year, to a period protracted beyond the usual worl season, and who, therefore, very naturally looked that of the other States should furnish the active member fo continuance of the work, did not feel himself particu called upon to provide for its conclusion. He merely municated the preceding facts to your Excellency; by v he believes the same views were entertained as by hir and no proposition having been made by the Commissi from Delaware, to proceed, the whole Commission wa tually dissolved, to the great personal regret of the U signed, who believed, and is still of opinion, that he involved in the execution of the works projected in th port, interests of vast extent and importance. The mission, however, before thus voluntarily ceasing to applied itself to the investigation and adjustment of th rious accounts of expenditures which had been made its authority, and all matters connected with these wer duced to their proper form; but the statement and auth cation of these accounts will, of course, be exhibit your Excellency in another manner, and do not pro come into this report.

The Undersigned will conclude what he has to offer this head, by adding, that he has caused to be prepar the maps connected with the subject, so far as the unfin state of the details would allow: which are he [illegible] turned, consisting of:

1. A chart of the headlands between Chincotigue inl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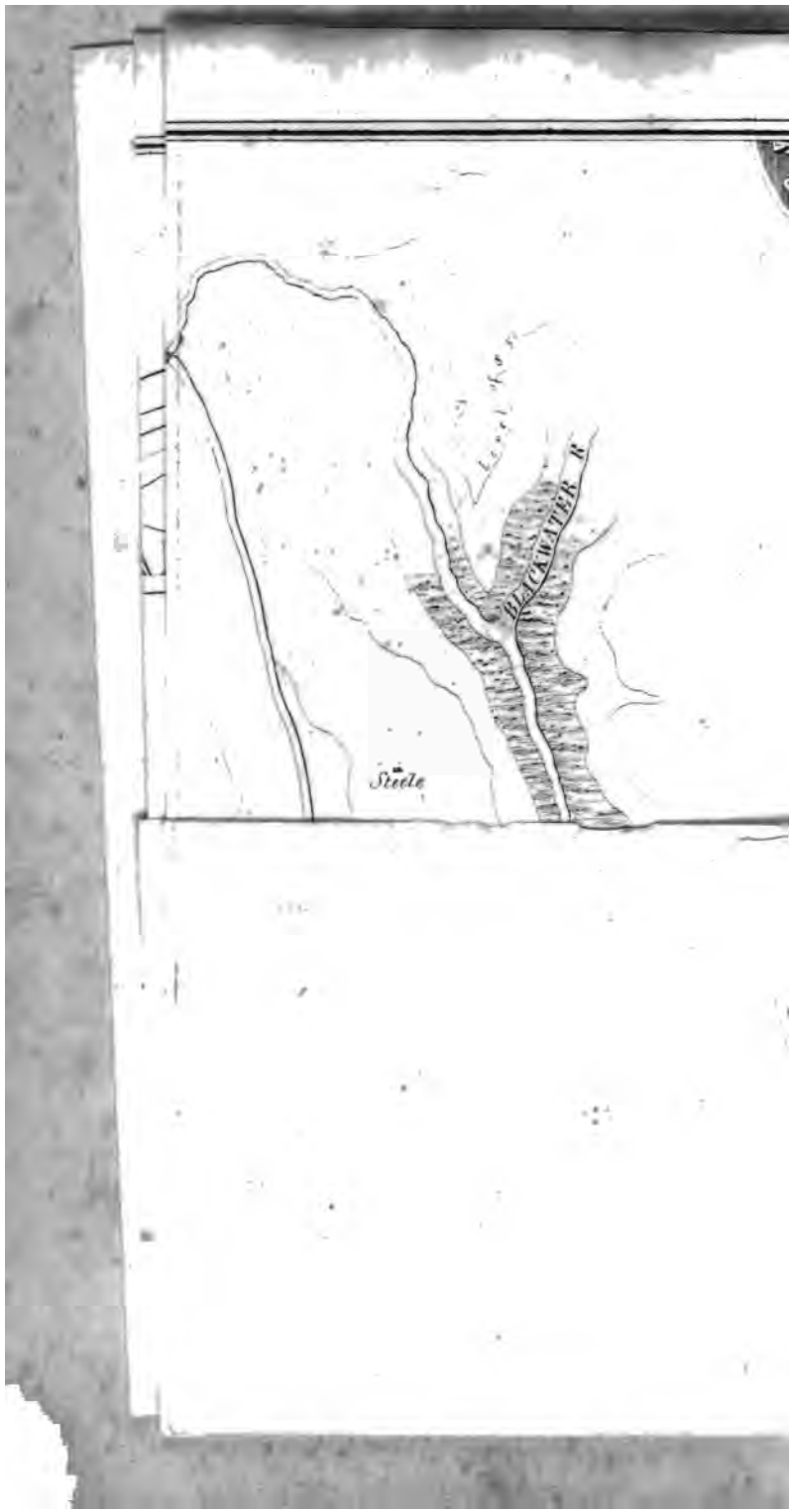

BLACKWATER R
Steele

Fenwick's island; the one point being somewhat below the northern line of Virginia—the other containing a boundary stone between Maryland and Delaware—The survey of the channel, with soundings, which could not so conveniently be made with one party, was among the matters left for this year, and therefore cannot be exhibited: but, under the precautions which the Undersigned was careful to take, all of the points can, at any time, be precisely ascertained and re-occupied, and the soundings made whenever the progress of the trigonometrical survey shall have reached that district.

2. A map of the line run to ascertain the direction of the Canal in the neighbourhood of Berlin—from Ayre's mill, at the head of Trap creek, to the head of Herring creek. This is the only work of construction actually necessary in Maryland. The location was established only so far as to enable the Commissioners to make their report.

3. A map of the location of the Canal from Assawoman, across the Turkey Branch creek to White's creek in the State of Delaware. This will be probably a final location.

4. A map of the location from Rehoboth bay, at Warren's creek, to Woolff's branch of Lewes creek.

5. The profiles of the several lines and locations.

6 The Projet of the triangles to be made use of in the survey of the Rehoboth bay.

Definite observations were made only at two or three points.

These maps are all labelled in the margin, and numbered progressively from No. 1 to No. 6, inclusive. Copies of all these maps had also been made by the Undersigned, for the use of the other Commissioners.

II. *The Choptank and Blackwater Canal.*

This is a Canal of Navigation, to unite the waters of the Choptank river, at or near Cambridge, with the waters of Blackwater river—a stream which, taking its rise about two and a half miles south of the town of Cambridge, has a course of about twenty miles south and east, to join in a gulf of the Chesapeake, called Fishing bay.

The advantages of such a connection might be found in a variety of ways. The basin of the Blackwater and the Transquaking (for they have virtually the same) abounds in timber—some of good quality for building purposes—all of excellent growth for fuel. These articles, supposing them at the mouth of the river, have still a distance of 70 miles to their nearest market, Annapolis; and of 100, nearly, if

they are carried to Baltimore, while from Cambridge, the distances are respectively about 43 and 70 miles.

To take the mean case—the position about half way of the river—the route to Baltimore by the present facilities (not all either in the same direction, nor to be performed unless with the wind abeam, or nearly so) would exceed in length 110 miles: could any transit be effectuated through Cambridge, the route (all too in the same direction) would not be longer than about 80 miles: making in this way, an arithmetical saving of very nearly thirty-three and a third per cent. in time. That saving will be found during about five months of the year, with the probabilities of prevalent winds, to amount actually to about 70 per cent.—a gain of no incosiderable account, when it is considered that time is always money, and often more.

Connected too, with the navigable purposes of the Canal, would be, of course, established, *systems of drainage*, which are so desirable, not only for that particular district, but for a great portion of the Eastern Shore—an operation at once salutary and productive—increasing both the quantity of the materials for work, and the number of hands to work them. Already the scheme of an enterprizing citizen, to people with the industrious denizens of another clime this very portion of country, has failed, because of the dread of the unwholesomeness of the exposure, a danger which could, in the event of the improvement, in all probability, no longer be apprehended, while an area of at least 100 square miles now in great part unproductive, could be redeemed for the uses of its present and an increased population, and for the interests of the whole state.

To render this improvement decidedly permanent, and to impart to it the extent of beneficial influence which it is capable of being made to exercise, the contiguous basin of the Transquaking, should also be taken in, and connected by lateral trenches or canals with the improved bed of the Blackwater. Indeed it would be impossible to create a complete and permanent drainage otherwise: and it is believed moreover, that the commerce of the Transquaking is no less worth the necessary care and expense than that of the Blackwater, so that the connection might be made as well by canals of navigation, as of irrigation.

It would have been a matter of profound interest to the Undersigned, had his instructions allowed him to consider the basins of these two rivers in this point of

and to institute the necessary examinations as to
nfiguration of the ground, the progressive changes
nature herself is daily carrying on in the soil, the
urse of the inhabitants, and other topics of scien-
d popular interest, necessary to be illustrated be-
y plan could be projected of alteration or improve-
The entire triangular space between Honga river
west, and the Nanticoke on the east, and whose
al axes of drainage are these Transquaking and
vater rivers, would have been in that case the
of his operations: and, so far as circumstances
rought under his knowledge the condition of that
, he would have contemplated with considerable
nce, the entire redemption of thousands of acres
ile land, from the marshes that now incumber and
hem. It did not appear to him, however, that he
arranted in any thing further than such an exami-
as would indicate the configuration, level, and na-
the ground immediately between the two limits,
had been marked out; and he therefore only lo-
a line in the direction in which the improvement
the greatest advantage, be taken. He reports a
f this line, (labelled in the margin, and marked as
,) which will illustrate what he has said; and from
els which were taken during the survey, he has
ed an estimate of the probable expense of the

ill be seen from this Map, that beginning at the
of the south-west arm of Cambridge creek, the
of a canal can easily be carried along the ravine
arm, through a narrow neck of firm land, and then
a natural sink, the head of the Blackwater stream.
ummit of firm land, (which is itself not more than
t above tide,) extends very little more than 4,000
nd the whole amount of excavation, as calculated
ous ways, cannot exceed 356,440 cubic yards. The
this excavation becomes the next subject of con-
ion.
hout entering into the minute details, it may be
lly stated, that, with a good hand, each cubic yard
dy loam costs $00.5 for the excavation; and that
nsportation of it, by hand, through stages of 100
osts $0.05 more; with horses and carts, the trans-
on would average for a haul of 300 feet, $0.058;

and for every additional haul of 100 feet, the trar
tion costs $0.099 nearly: or as is more common
one cent for every hundred feet. In an excavatic
this would be, where the length of the haul is at
posal of the contractor to do the work, the cost p
might easily be kept within the limit of the lowe
mate, viz. 10 cents. The ordinary rates of wag
cost of ditching in the neighborhood, which is
ordinarily done by the perch of length, but is ca
being reduced to cubic yards of content, woul
about 9 cents per yard.

The Undersigned is inclined to believe from su
culations and comparisons as he has instituted
mode of transporting excavation, not so much pr
in this country as it appears to deserve, would ma
cheapen the cost of such works. He alludes to t
struction of temporary rail tracks, by which the
of the horse, (or the human force, which may, in
cases be advantageously applied,) is of course ver
increased; and, in the use of which, many sit
would allow of gravity's becoming the moving
not only to carry the loaded cars down, but also t
the empty cars up. In the calculation, which, in
gard, he has applied to this particular case, the
excavation and removing the earth, would be abo
cents per cubic yard. The mean among the three
gives an average price of nine cents per yard.

The contents then of a canal such as is propos
tending from tide to tide, and which may be b
within the limits of 22,000 feet in length, whose
sions would be 19 feet at the bottom, with a water
27 feet; the sides of the cut rising by regular b
and proper allowance made for side ditches and
will be about 356,337 yards; which, at nine cents,
amount to $32,070 33.

This sum, it is apprehended, could fully finish t
ticular improvement which has been surveyed.

The route whose details are exhibited in the
panying map, (No. 7,) is not the only one whi
been suggested as satisfying the particular aim i
The south-east arm of Cambridge creek would al
nish an eligible means of connection; and anothe
through Jenkins creek, to the west of the presen
but joining with it somewhere about the station

XII. has also been thought of. With the view, however, which the Undersigned took of his instruction under this topic, he was not allowed to devote the time to institute such detailed inquiries as would be necessary, were the immediate construction contemplated. Looking upon himself only as authorized by the State to examine and report upon impartially the wants and situation of this district and the others, where, in virtue of similar authorization, similar surveys have been made, and upon the feasibility of applying a remedy, he was only permitted to investigate the matter so far as to satisfy himself that the thing proposed might be done; and in promptly taking what, if it be not the best route, is at least not inferior to any of the others proposed, as the basis of his inquiries and estimates, the object of his commission appears to him in so far satisfied. Local reasons which have come under the observation of the Undersigned, but which it is not necessary to advert upon here, might, in the last resort, influence a decision in favor of some one to the exclusion of the others; but he would distinctly state, that all are practicable, and at an expense commensurate with the advantages which it is believed would accrue from their adoption.

Before concluding this subject, a remark already made may properly be repeated—that the execution of this improvement will effect but little, comparatively, unless connected by similar means with the Transquaking; and that still more beneficial would be an extension to the Nanticoke. The limits and nature of this report do not allow, however, of any extended remarks on this subject. The Undersigned would only be understood to say, that by a judicious application of the means which would present themselves to one who has studied, and is practically following out the subject, the difficulties in the channels and mouths of all those rivers might in a great measure be removed, and Fishing bay become again navigable for vessels of a much larger class than ever venture into it now.

III. *The survey of Piscataway creek.*

The map herewith returned (labelled in the margin, and marked No. 8) will exhibit, it is believed, the nature of the difficulties for which a remedy is desired.

This valley shows, as well as any other place which has been observed by the Undersigned, the changes which a course of years is producing, not only there,

but in many other streams, by a succession of alluvial deposites along their banks and bed. The circumstances tending to these deposites vary of course in each locality, and suggest, when they have been accurately observed, a modification in the application of the general principles which govern in all such cases. The Undersigned may be permitted to dwell for a few moments upon the development of these principles; first abstractly, and then in their effect upon the present case.

The waters of every stream carry down in suspension with them more or fewer earthy particles, derived in part from the abrasion of their banks and bed, and in part from the rain-washes of the adjoining lands. So long as the velocity of the stream (which is dependent upon the inclination of its bed and the sum of the widths of its bottom and sides) continues uniform, or goes on increasing, the particles held hitherto in suspension will continue to be so; and there will be little or no alteration in the bed under these circumstances. But whenever there occurs any accidental or natural cause of diminution to the velocity, the tendency will be immediately to deposite all or a part of the earthy matter in suspension; and in proportion to the amount of that tendency will be the alteration in the stream's bed. The *accidental* causes may be the rolling in of a stone, the overthrow of a tree, the sinking of a boat, or, what is more than once observed to be the case, an abundant growth of aquatic plants, whose seeds have been brought there during rains or high winds, or by birds in their passage. The *natural* causes operate first and principally at the mouth of the stream, where it enters its recipient; which may be either the sea or a bay, or a large river, either affected or unaffected by tides. The stream coming down meets there a body of water moving in a different direction, and with a greater velocity than its own; it is of course checked; and the sedimentary deposite takes place at that point. Generally speaking, all that portion of the section of that stream which lies below the level of low water in its recipient, if that be a tide stream, may be considered as a mass without gravity and without tendency to flow, except in so far as its adhesion to the upper and moving stream affects what is known as the lateral communication of motion in fluids. The average velocity of the whole mass, which is made up of the ve-

locities of the superior and inferior strata, will be by these means considerably diminished; even on the supposition that the direction of the course of the recipient is only slightly oblique to the confluent, and that the level of the recipient continues uniform. Where this supposition cannot exist (as is the case of all recipients affected by tides,) the effects just now mentioned are produced but in a greater degree. The confluent stream, at the period of flood tide, is met in its progress, before reaching its mouth, by a current flowing in an opposite direction and with an accelerated force—of course its velocity is retarded—a deposite of its earthy particles takes place not only at that point, but through the whole extent of the retarded velocity commonly called "backed water:" and the bed of the river is, of course, altered and made more shallow in proportion to the amount of the deposite at any time. And the evil (if it must be called one) is increased by itself: the particles of water passing over the place of the deposite, feel themselves proportionally retarded and incline there proportionally to part with earthy matter previously in suspension.

Whenever the deposites are to such an amount as to render the stream so shallow, and in consequence to retard the velocity of the stream to a degree that the water can no longer at any point, hold in suspension the earthy particles washed down by the rain, the progress of its being filled up, which has hitherto been slow, (in consequence of occasional antagonist causes not hitherto adverted to, such as frequent increase of its velocity by sudden and heavy rains, &c.) becomes very rapid: the stream no longer even fills the whole of its now contracted bed, but wanders through it "seeking soft places," or evaporates in stagnant pools, until it is converted into the waterless gorge that every traveller has seen.

When these causes and effects, which, together with the action of winds under certain circumstances, as agents in the transport of earthy particles, are associated with all lacustrine formations, are applied in the consideration of the circumstances of the present case, there will be, it is believed, but little difficulty in the suggestion of the efficient remedy.

The stream of the Piscatawa may have been originally, before the present difference of level between mid-tide in the Potomac and the surface of the Green Landing

and other marshes, a considerable tidal arm of the latter river—every where nearly as wide as to the bases of the hills which now inclose it. It certainly afforded, fifty years ago, a channel for vessels of good draft up to and a little beyond the Tobacco Warehouse: where now, as is seen on the map, the soundings, at quarter ebb, give only 1 foot 10 1-2 inches. This depth is increased at high-water to about 3 feet. Nearly all the causes which have been mentioned, accidental and natural, appear to have operated in producing the present condition of its bed—the bends and elbows in the channel, which were not before alluded to, had their share in effecting a retardation of velocity, and in furnishing a superabundance of sedimentitious matter; and the construction of a mill-dam (which, for all that is known, may have done a greater amount of good than evil,) has contributed an acceleration to the agencies before at work. The progressive changes attributable to these causes, if they are to be judged from the effects of the last two years, are going on with considerable rapidity. Shoals of soft mud and shells, which were passed over at that period, are now islands, covered with marine grasses and aquatic plants, and submerged only at high tide: and the public landing, once at the Warehouse and afterwards nearly a half mile below it, is now difficult of access and appears to be fast receding down the river. The amount of soil continually deposited from the adjoining hills during rains and freshets appear to be very considerable. Occasion was taken, during the examination, to measure what was said to be a single deposite, and which, even if it was more than one, had been effected in a short time, since the grass of the old surface was still, in many places, green beneath it: and the Undersigned was surprised to find the depth very nearly four inches.

The alkaline nature, too, of portions of the earth washed down, consisting of green sand and disintegrated shells, appears to be calculated to promote the effect of these natural *colmates*—(by which name, formations of new upon old soil have been long known to the Italian and French Engineers)—the scattered seeds of plants find almost every circumstance favorable to vegetation, and the obstacles of the stream, coated over their surface by leaves, and held together lower down by roots, are much less calculated to yield to any occasional and

violent increase of the current from freshets or otherwise, than if they were merely accumulations of a barren silt or mud.

The knowledge of the mode of existence of the evil leads, as was already said, to the knowledge of the mode of cure: and to all these circumstances may be applied a remedy, which shall be thorough and certain. Yet it is not to be concealed, that under the circumstances, which will be fully detailed directly, the remedy may be more costly than useful, and it can be readily understood that there will be often conditions under which all the sufferings of the case will be easier than the mode pointed out of relief or avoidance. The first thing then to be done is, to shut out from the bed of the stream all the water which now brings down the sediment from the hills. This is to be effected by the digging of auxiliary canals or trenches along both sides of the stream, which shall receive this water and convey it either into the Potomac below the mouth of the creek, or else be made to unite with the creek itself at some point where the additional quantity of water thus furnished will be serviceable. The size and direction of those canals are not matters of arbitrary choice: but depend, in order to the effectual working of the improvement, upon the quantity of water which is to be carried off by them. Their transverse section must be sufficiently large to contain the quantity which the average annual rain furnishes, as well as the running water brought down in various places by tributary streams—all of which, from the point where the improvement is to take place, should be shut from the creek itself. Their slope should be such that the velocity of the water shall never go on diminishing, but, at least, be uniform, in order to prevent any deposite in themselves: and will be, of course, proportionable at any point to the area of the transverse section at that place. If it should be determined to pass them into the river it would be advisable to run them along a higher level than that of high water, and if convenient, to furnish them at the point of junction with a chute of woodwork, or masonery; so as to prevent, at once, both the action of the tide in backing their water, and the tendency which it would have to form a shoal at their entrance—either of which would alter and render unavailing the proportions established between the other parts. This would

be, if possible, the most advisable course: inasmuch as to the most effective application of expense and labor, the auxiliary canals should be in operation and answering their object, simultaneously with the commencement of the work in the bed of the stream: otherwise, as the proportion of the slope of the confluent and recipient respectively indicate and determine the direction of the line of influx, the two operations would have to go on together—a mode of procedure to be sure sometimes practised, but not at all, in many respects, the most advantageous.

Supposing the auxiliary canals executed, (if the connection is with the river and the lower points of the creek,) or at least laid out and their profiles and cross sections determined, from knowing the configuration of the valley—the expense of the streams tributary, and the yearly average of rain, the next object is the clearing out of the bed of the creek, which may be effected in a variety of ways; all perhaps equally good under certain circumstances, according to the inclination or ability of the practical workman who undertakes the task. The only requisites to be observed, are those deducible from the principles already stated, viz: that the transverse section, at any point, be capable of passing all the water that shall be allowed, or can be expected to pass through it; and that the slopes be so managed, that the velocity of the stream shall continually increase towards the mouth, and the velocity immediately at the mouth be sufficient to impress a partial change of direction upon the water of the river, in order to the deposite not being made until the water of the creek shall have been propelled a distance into the river.

If, as is believed to be the case here, the stream is liable to be extraordinarily affected by high north-east winds, and tides, the cross section should be doubly-trapezoidal, i. e. the ordinary section of a canal with another and larger superposed. The velocity will be in this way less liable to retardation from backwater, and a violent rain would less sensibly endanger an overflow.

These considerations are only such as would suggest themselves of course, to any one applying himself to the subject, or charged with the execution of the work.—The Undersigned may be allowed to express his perfect confidence as to the probable and permanent success of

these principles, applied in detail, as more minute examinations of the locality would dictate and justify: at the same time he would state, that the improvement, if executed in this manner, would cost not less than several thousands of dollars. It remains for those who are individually interested, to say how much will be the value of the improvement when made.

It is true that more than one mode of *palliation* exists which could be applied at a much cheaper rate. In the course of his enquiries, the Undersigned found occasion to reflect upon and arrange several plans, by which the present difficulties could be rendered less; none of them however perfectly satisfactory in their probable results, nor affording permanent security against the operations of causes which they do not touch. He has therefore found reason to abandon them all, and to the plan whose general outlines he submits, he would refer your Excellency and the parties interested, as the only one likely to be thorough and lasting, avowing his readiness to prosecute and prove its details whenever directed by the proper authority.

In what he has said, he would not be understood to undervalue the importance or necessity of the improvement; he would ask rather to mention the circumstances which were alluded to just now, as possibly making the remedy more costly than useful; circumstances whose consideration when presented to him affected his views considerably.

All that appears to have been contemplated by the parties principally interested, in such an operation as would make independent of the times of high water, the access to Green Landing—the produce, principally tobacco and grain, would be then, as now, hauled from the warehouse or the grounds of the different proprietors to tha landing, where it would be loaded up in a scow, or vessel of light draught, and conveyed, when the tide serves, to the mouth of the creek, where there is a deep water landing near Farmington; there the produce would be re-loaded upon the schooners or river craft, which ply between that place and Alexandria, the principal port of that District. The cost of hauling a load from the warehouse to Green Landing is at present twelve and a half cents; the cost of carriage of the same load to Farmington, by scows, thirty-

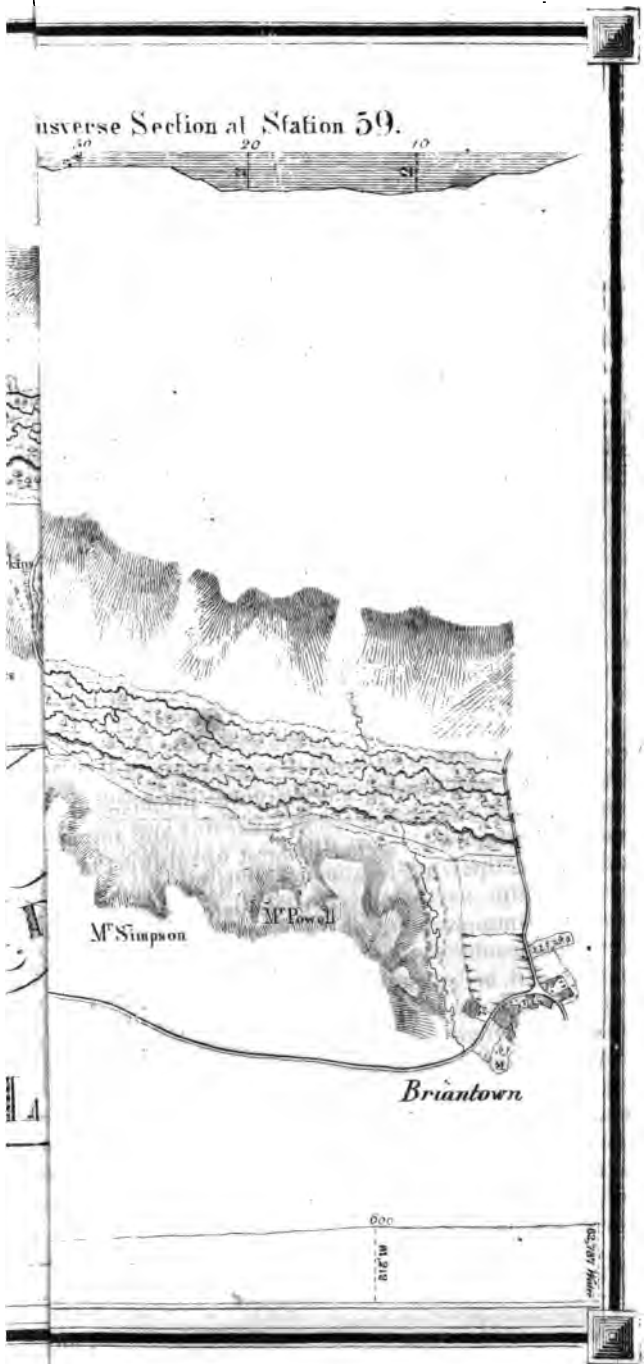
seven and a half cents, making in all, half a dollar for a transit down the creek.

A citizen, resident near the creek, either has already opened, or is about to open, a road through his property between the same points—the warehouse and Farmington; by which the distance will be made somewhat diminished, and the cost of conveyance for the same quantity exactly the same: leaving, however, altogether, as it appears, an actual difference in favor of the land route; in which there is only one loading and unloading instead of two, as there is by the creek, and where there cannot be, as in the case of the creek, any cause of delay, at least, while the produce is yet unsheltered. The times of performing the distance would not materially differ.

The plan recommended in this Report would, it is true, effect an alteration beyond what appears to have been contemplated hitherto; inasmuch as not only the Green Landing, but the Warehouse Landing, and much higher up, would be rendered accessible at all times to the river craft themselves, without the intervention of lighters, and the system of auxiliary canals, which would operate as canals of irrigation and drainage, would soon render pasturable the recent marshes which are now already giving promise of becoming fine meadows. Yet upon a careful and impartial consideration, the Undersigned cannot but think that the interests of the parties interested, if it be proposed to execute the improvement at their private expense, will be as much promoted by adopting the land carriage and proposed road, as by executing the other and paying the cost of it. If it be proposed, indeed, that it be done by the State, the views of the Undersigned have been already expressed with sufficient distinctness elsewhere, not to need any repetition here. He hopes only, that in discharging, by this Report, his part of a pulic duty, he will be thought to have paid the proper attention to the welfare of those concerned, the general interest of the public, and the statements and views confided to him during his examination.

IV. *The drainage of Zakia Swamp, or Allen's Fresh Canal.*

The Undersigned will now call the attention of your Excellency to another proposed improvement, which afforded great interest to himself, during the examinations he was allowed to make, and whose execution appears to him by no means of questionable importance.


nsverse Section at Station 59.
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Mr Powell
Briantown

This is the drainage of the swamp containing the head stream of the Wicomico river, in Charles county.

The maps returned herewith, (labelled in the margins, and numbered from No. 9, to No. 12, inclusive,) will give, it is hoped, all the information which, at the present stage of the subject, could be desired, or was to have been collected. Besides which, in order to afford a more comprehensive view, another map, (No. 13,) is also subjoined, in which the details are contained in a smaller scale.

The character of the difficulties here appear to differ from those already detailed as occurring in Piscataawa creek, more in their age and the longer period since their first existence than in any thing else. If there be supposed a large tidal river varying from a quarter of a mile to three quarters in width, and enclosed on both sides by hills, exceeding in height one hundred feet above its surface—whose light soil would be well calculated to furnish to every rain that washes their slopes a portion of its particles, and to every wind the sweepings of its surface—a probable view may be taken of the original condition of the basin of Allen's Fresh.

The circumstances tending to produce changes in such a basin are very easily arranged: where the running part or head of the stream met the marine or tidal part, a check to the velocity of the former would be twice in the twenty-four hours experienced; and the particles of soil from the adjoining hills, which the previous velocity had held in suspension, would be there deposited, forming a sort of bar, which tended more and more to retard the water passing over it: of consequence more and more would be deposited, and higher up the stream. This bar would be at first of considerable width; because the point of appulse of the tide and current where, the force of the former would be sufficient to cause a deposite would not be always the same, and because all the particles of the river cannot be supposed charged alike with earthy matter. To-day the particles most heavily charged would be met at a given point in the stream by a sufficiently strong flood tide—to-morrow, at a point far below the first, they would be urging the pursuit of a retreating ebb: so that within certain limits almost the entire bed would be liable to deposites greater or less, while that part of the filling in which the winds brought would of

course be still more irregular and general in its distribution. Occasional freshets, too, would sometimes swell to an unwonted degree the impetuosity of the running water, and thus carry still further, to sea as it were, the detritus of the land. These various causes, once in operation, do not, as we have seen, need a great while to be effective. Accidental obstacles, attracting local deposites, soon are converted into shoals, bulkheads, and finally islands. On these, aquatic plants, which first of all served to hold their agitated soil together, give place before long to the shrubs and trees of firm ground, and the swamp growth is fully established. Every thing thus helps the other, and the great operation of nature, incessant change —which some call reproduction, and others decay, is in this manner carried on by an accumulation of causes which, in themselves, and separately, appear indifferent.

It seems not improbable, that in some scores of years the basin of Piscatawa, subjected to causes such as these which have been thus rapidly sketched, may assume the features these causes are likely to form; and that if left to itself, the now almost cultivable portions of marsh meadows will after a while be covered with the tangled growth of shrubs, briars and young timber, fully entitling it to the name of a Swamp. It is not less probable that Allen's Fresh at one period presented an appearance highly analogous to that of the present Piscatawa, and that the differences in the two arise, as was before said, more from their respective ages than any thing else.

The physical outline of Allen's Fresh, so far up as surveyed, is, as may be more clearly observed in the map, that of a long basin or trench, hollowed out between adjacent highlands, to an average width of one-third of a mile, to a distance of twelve miles from tide-water; having its direction for a third of its length about north, for another third about north-north east, and for the remainder about north-east. The highlands from barometrical measurements, attain an elevation of 108.97 feet above tide, with a slope on the horizon of 40°; their soil varying from sandy to clayey, and covered with a considerable superstratum of small sized gravel. The bottom of the basin, formed of the soil of the hills and decayed vegetable matter, is inclined upon the horizon at an angle of four and a half minutes nearly, and being generally level transversely, is for the most part covered with wa-

ter. At least, after a few hundred yards from the tide-water, and a little above where advantage has been taken of the stream for the erection of a mill, the difference between what may be called the main run and the subordinates is so little marked as hardly to distinguish them; and the foot, in passing over it, finds nothing but a succession of miry knolls, whose unpleasant monotony is varied from time to time by plunges into water of three feet and more, and very rarely by brief resting places (few and far between) of firmer dryer ground. The cause of this is in the roots, and still more in the fallen bodies of trees, which every where obstruct the course of the stream: so that its real velocity is hardly more than one-third of the velocity due to its actual fall over an uninterrupted bed.

Nevertheless, amid all these apparently unfavorable circumstances, there is good ground for believing in the possibility of the ultimate and not disproportionally costly or difficult redemption of the Swamp. That a canal of navigation could be constructed in the basin is also a matter of possibility: but under the circumstances of expense attending it, and of its comparative utility when made, not be desired or attempted. Canals for the outlet and drainage of the water—*canals of irrigation*, as they may be called—the only ones suitable to the provisions of the case—may, it is true, be so combined as to present certain facilities for downward transit; but it should be carefully borne in mind, that this is not the primary object in view, but only that the opportunities which may be afforded for the purpose in the ulterior prosecution of the work, if executed, should then be taken advantage of.

The quantity of land, (at least three thousand acres,) in the portion surveyed, which might be saved from annual inundation and rendered arable—and that land confessedly the best and richest in not an unfertile region of country—appears to the Undersigned, and will appear, he is sure, to your Excellency, a sufficient reason for an attempt, which is capable of being based upon such processes as to be almost certain of success: and if, as has been stated, hardly one crop in nine of the lower slope of the highlands metes to its planters a fair return, it would certainly seem that the interest alike of the wealthy and the poor in that district urged strongly the

necessity of some union of purpose and effort among them, and the propriety of some public interference or legislative aid. Two-thirds of the present market price of land, unredeemed, cannot be a reckless outlay for an improvement which will upon its achievement double the value of the other third, and render more than double its present rate of interest; and the public money can hardly be laid out better than while, when it is fostering the industry of any portion of the community, it is shedding the influence of expanded views, and a good example over the remainder.

The Undersigned will, as briefly as possible, conclude what he has to offer, in this part of his report, by an exposition of some of the principles, and of the general plan which might be adopted for the attainment of the ends in view. If he should seem to hazard in this a partial repetition of what has been already stated in reference to another topic, it is to be hoped that the importance of the matter will make up for its tediousness, and the nature of the subject atone for the manner in which it is all but impossible to avoid its treatment.

In the draining of any land, subject to inundation, there are two general modes, which suggest themselves as likely to attain the object:

1st. The elevation of the surface of the *lands* themselves.

2nd. The depression of, or the furnishing of a proper outlet to the *water*.

In some cases there may be an opportunity for combining both methods, which, however, does not appear to take away their paramount generality.

The first method may be satisfied in the employment of either of two ways.

1. By an actual embankment, or filling in of a stratum of foreign soil, thick enough to raise the lands above the level of the sources of inundation; giving it at the same time a sufficient inclination, in any one direction, to enable it to throw off the rain or other accidental causes of overflow.

2. By a method whose name and practice principally has been borrowed from the Italians, viz. that of *colmates*; which takes advantage of the very cause itself of the evil, and consists in such an arrangement of artificial channels, that the waters, directly they become charged

to a certain degree with earthy particles, shall overflow their banks, and make on the face of the lands their deposites. The arrangement is further combined, so that the waters shall not remain longer than to make that deposite; but they are then immediately drawn off: otherwise an infiltration would take place, and all the evils ensue of uncorrected inundation. The heavy deposite which was, a little while ago, mentioned as taking place in the Piscatawa, is an illustration of the practical *natural* operation of this method; where a stratum of rich soil, to a thickness of more than three inches, was in a short time, and by one overflow, very generally spread over a marginal meadow of moderate extent.

The great expense of the first of these ways, except in cases requiring but small assistance, would prevent it from being generally used; and it is, besides, not at all applicable to the present case. The successful application of the second requires a most careful investigation of the associated circumstances; and, moreover, a happy and not common natural combination of them. Not a few instances are on record of expense incurred fruitlessly, and money wasted without return, in the unfortunate resort to this remedy. Although it appeared to the Undersigned, at the time of his investigation, that there was a considerable number of incidents favorable to an employment of this means, he must confess himself as yet, until more enlarged and detailed researches, not able to speak fully upon the merits of such a plan in its adaptation to the present case.

2nd. The second general mode of drainage is by a *drainage*, properly so called; *i. e.* the provision of a sufficient avenue and outlet to all the waters which are causes of the inundation. As this appears unobjectionably applicable to the case under consideration, it deserves to be longer dwelt upon. The waters which tend to produce inundation are of two kinds: the one water furnished by rain, and therefore called *pluvial* waters; the other furnished by the tributary streams, and therefore called running or *littoral* waters. The former have been by some persons, but improperly, called *stagnant* waters: there is nothing *stagnant* about them. The difference in the origin, nature, and mode of action of these two kinds, suggest a difference also in their mode of treatment; and in arranging to free the lands of their unwel-

come load, nothing should be held of more primary importance than to keep distinct the operations for both. To mix them together, in the provision for their discharge, is at once to throw away nearly all the advantages of control which might be expected or derived for a proper construction of the necessary works.

It must be premised, as an essential preliminary, that the drainage of a part of Zakia swamp could not be advantageously attempted without including that of the whole. The authority of the resolution authorizing the labors of the Undersigned, appeared to contemplate a canal of navigation from tide to an important point, Briantown, and extended the demand for the survey no farther. Under circumstances different from what existed at the time of reaching that place, he would have thought himself justified by the spirit of the resolve and the exigencies of the case to have continued it:—at the time it was impossible. As it may however safely be pronounced, if not impracticable, at least improper, to attempt a navigable canal at all, it follows at once that to be most efficiently, as well as extensively useful, the drainage should commence where the evil has its source.

This being understood, it seems manifest: that if—1st, the waters of the stream and its tributaries—which have been called the *littoral* waters—could be carried off along the foot of the highlands, on either side, into the Wicomico, and thence into the Potomac, with the proper degree of velocity to prevent the deposite of earthy matters in the bed of the former: and then, 2nd, a canal, or system of canals, be constructed in the lowest ground of the swamp, of proper dimensions to contain all the *pluvial* waters which could, in a given time, fall over the area included by the bases of the hills: the object in view would be attained. The swamp itself, by this means, free from the constant supply of running water and of the rain from the hills, would be kept up only by the rains falling on it, which would, of course, be a very much smaller quantity. Every calculation of probability then would be, that evaporation, infiltration, and the descent of the surface would be sufficient to carry off the moisture derived from that cause, and the marsh thus become dry. These means form the general plan which will be proposed.

1. Commencing at the head-waters of the swamp—at

the foot of the highlands, on both sides, canals or trenches, reaching to any convenient point on the river, may be cut along the ground most adapted to their construction. These are technically called *canals of the circumference.* The direction of these trenches should be as nearly straight as may be, in order that the calculations for them should not be burdened by a great variety of complex resistances: their transverse section must be sufficiently large to contain all the water to be furnished, not only by the main stream, but by every tributary as it joins in —and their slope, which in every case is proportioned also to the transverse section, must be sufficient in itself, or by a system of falls, to communicate to the water in its progress a continually increasing velocity. In this way the area of the marsh itself is kept free from the effects of irregular or improper deposites: and the stream, thus shut off and turned, no longer offers any obstacle to the operation which must next be carried on in the marsh itself.

2. This operation is the excavation of a central canal in the lowest ground of the marsh, commencing at its head and terminating at tide, to carry off the pluvial waters falling on its surface. As it now receives none of the rains from the hills, and no part of the original stream, the canal, it is plain, may be much smaller than if it were intended to accommodate all; and also that its supplies will be much more regular and easily managed. The direction of this canal depends on the features of the ground: its characteristic is to seek the lowest land. Its transverse section must be calculated to hold the maximum quantity of rain (for the period in which the water accumulates so as to become hurtful) which has ever fallen in the whole surface of the marsh in a year or a series of years. Upon comparing the observations for this amount of rain, it may happen that on one occasion there has been an unaccountably disproportionate fall: if this be the case, and the difference of expense for construction in adapting it to this disproportionate fall be considerable—perhaps not much hazard will be run in suiting the canal to the average depth of all the falls. The regulation, however, of these probabilities is to be in every case left to the discretion of the observer. The slope of the canal, where the ground admits it, should be, according to the general principle, enough to cause the

water to flow with increased velocity: if this cannot be the case, a help is found in the canals of the circumference, whose waters may, from time to time, be let in to aid, by their superior velocity, the flow of the central canal. The construction of this canal, of course, implies the removal, where necessary, of the various obstacles which now choke the waters of the swamp.

The execution of these works and their details appear to comprehend all that is necessary for the successful event of the improvement: so far, at least, as the facts collected will warrant. Trenches auxiliary and parallel to the central canal may, in some places, be necessary: which are not understood as comprehended in its details. They would hardly be so through the whole extent.

Before, however, the state of our information would warrant the minute combinations of the plan to be arranged, a good deal remains to be done. The truest economy of time and money is always, it will be admitted, to spend a sufficient amount of both to put in the possession of the proper authorities every fact that can possibly exert an influence over the scheme, whatever it may be; and the melancholy example of more than one work of general interest, commenced from impulse, carried on in haste, and terminating in failure, is a sufficient proof of the advantage of bestowing great attention upon preliminary details.

The Undersigned may be allowed to advert now to some of the leading points of investigation which appear to him necessary to be obtained before the ulterior prosecution of the work: features which impress themselves, more or less upon the researches for every similar undertaking.

1. The exact configuration of the basin itself, and of the highlands adjacent and for some distance beyond: their extent, relative levels, and slopes, &c. are matters of chief importance. From the examinations hitherto made, it would appear that the basin of Allen's Fresh is actually larger than its superficial dimensions would show, i. e. the stratum of clay, underlaying the superincumbent mixed soil, slopes outwards and upwards, beyond the highest point of the gravelly hills—which highest point is the limit of the superficial dimensions: and therefore a part of the rain water, which, if it followed the slope of the external surface, would fall into the adjoin-

ing basins, does in fact filter through the upper stratum until it meets the clay beneath, and following the slope of that stratum, is conducted subterraneously to Allen's Fresh. It is, in short, what is best known under the name of a *parasite* basin. As this fact is calculated to exert a good deal of influence upon the proportions of the canals of the circumference, its accurate determination becomes of high importance.

2. The quantity of water furnished by the main stream and each of its tributaries, at the dryest and wettest seasons. Generally speaking, the more gaugings that are made of the streams, at any time, the better; provided there be also note taken of the preceding and accompanying states of the atmosphere.

3. The depth and quantity of rain falling, or likely to fall, for any given time, (as for instance a day) over the whole extent of the basin. The observations for this particular should be made continually at as many points along that extent as circumstances will allow: and the period of making them should not be less protracted than a year, during which time the recurrence of the seasons will exhibit all the probable variety and amount. If opportunity should be afforded of collecting the information for a longer period, it would be, of course, not neglected.

4. The influence of the atmosphere in producing Evaporation from the surface of the basin, both of the running and of the rain waters. The observations for this particular should be made as well upon the natural elements themselves (from which they are deducible by calculation) as upon artificial reservoirs, placed in different situations; and they should be carried on as well in open exposed situations as in those which are sheltered, as a considerable portion of the marsh would be by trees.

5. The influence of the soil in promoting Infiltration.

6. The time in which the waters collect themselves after a given amount of rain or freshet, so as to become hurtful and overflow the soil.

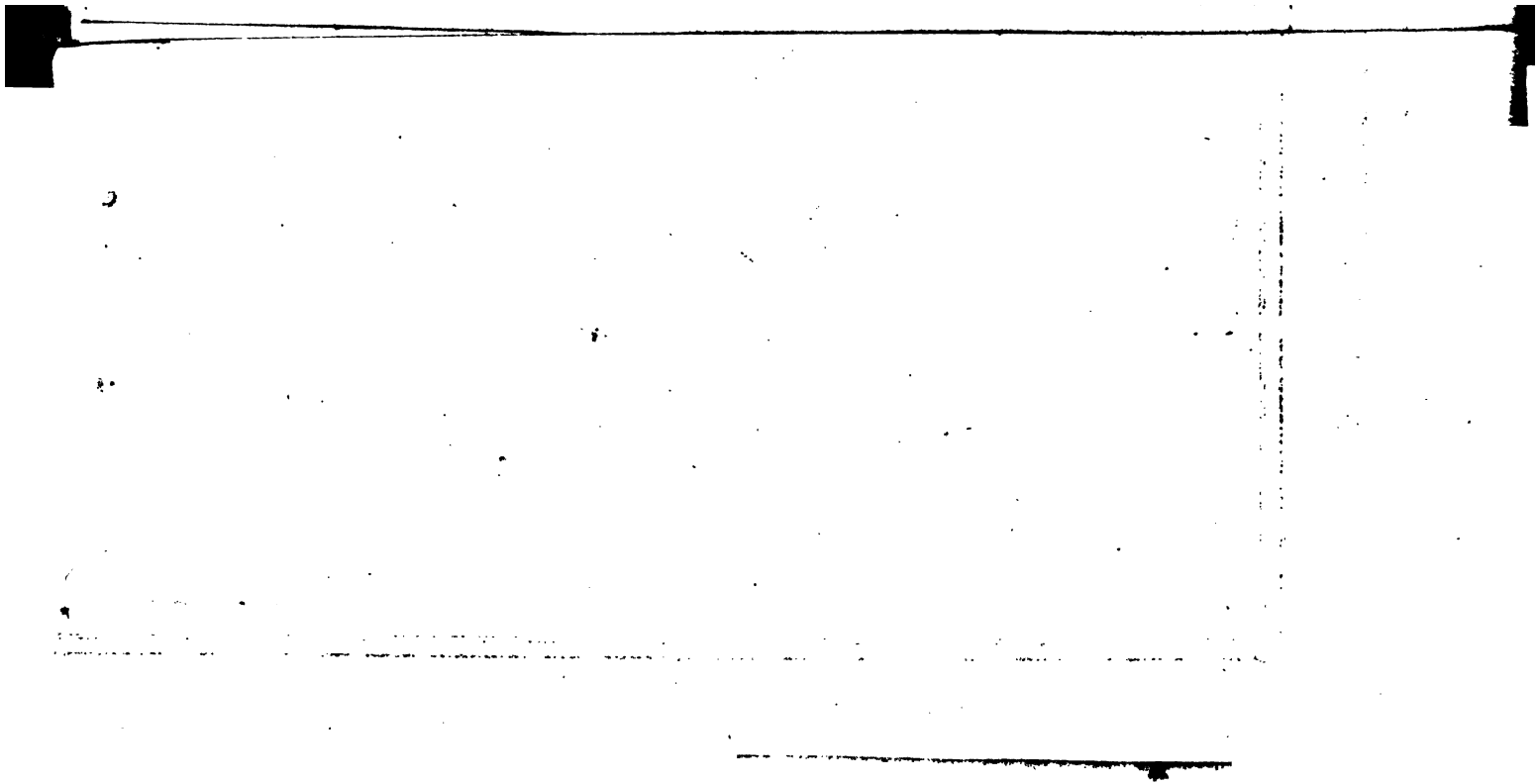
The instruments and means for making the necessary experiments and deductions, are within the reach of any one who chooses to apply himself to the subject. It is sufficient for the purposes of this Report to have indicated their results. It would seem that, with these facts correctly ascertained, there remains no difficulty to pro-

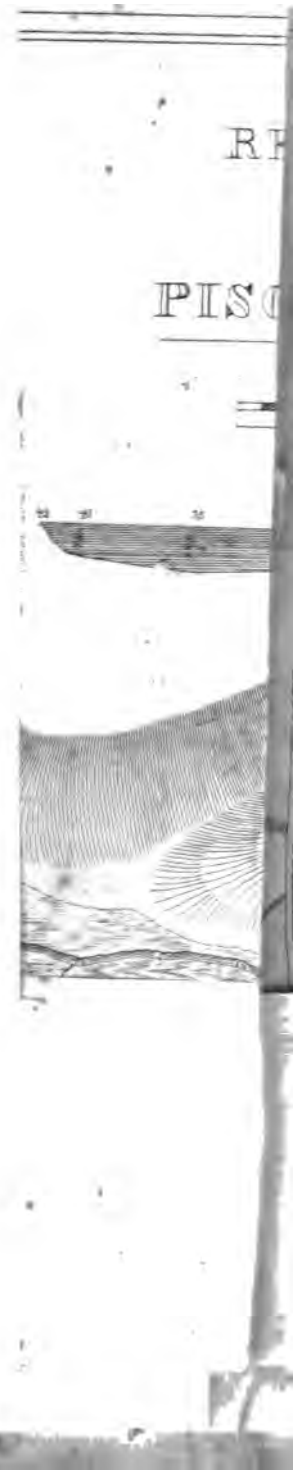
ject the work with such parts and proportions as to make it not otherwise than impossible that it should not succeed.

From what has been said it will be seen that the Undersigned, within the limits under which it was necessary for him to act, cannot now, in justice to himself, prepare any detailed estimate of the cost of the work, without being permitted to institute to a larger extent further examinations: he therefore hopes that what he has said and done may be considered as a discharge of his duty, so far as it has been laid upon him. His impartial opinion, as to the efficacy and importance of the improvement, has been already fully expressed, although under a consciousness of the feeble influence it is likely to exert. He leaves it now to the hands of others in nearer connection with it, who can, with more ability and greater propriety, urge its interests and adoption.

V. *The survey of the Pocomoke, from the head of tide, to the Delaware line.*

The proposed improvement of this river (of great importance when taken in connection with other auxiliary works, whose project will be presently more fully discussed and explained) has not been a topic of new concernment. Already so far back as the session of December, 1828, (Res. No. 18,) the Legislature ordered an examination to be made, under the charge of Commissioners, who executed and reported their plans. This report, which does not seem to have occurred to framer of the resolution more recently passed, may be found among the Public Documents, (Dec. Sess. 1829,) to which the Undersigned would respectfully refer your Excellency. It seemed, under all the circumstances, then, before instituting new examinations which were not authorized to an extent beyond these already made, proper to call attention to the latter; and the fact of their existence was, by the Undersigned, early in the past year, verbally submitted to your Excellency and the Executive Council, and instruction asked as to the proper course of proceeding. Had the call been made for information different in kind or degree from that already collected, the Undersigned would with pleasure have immediately answered it by a practical report; but it was hardly proper for him, without some better ground of dissatisfaction with previous results, than appeared to exist, merely to repeat steps which had been already taken; and he pre-





ferred suspending the matter upon the determination of those who had the right to direct his movements in relation to it. Instructions to proceed not having been forwarded to him, he of course left it in the state in which his verbal report had placed it, until something definitive should be communicated to him upon the subject. It is supposed, however, that all the information which the Legislature would desire for their action upon it, (if any action be intended,) will be found in the aforementioned report of the Commissioners.

VI. *The Trigonometrical Survey.*

The plan of the triangles (Map No. 14, herewith returned) which have been already laid out and approximately observed, will show all that has been this year achieved in this regard. The fieldwork and subsequent details connected with the surveys, which have hitherto been the subjects of this Report, occupied, with all the industry that could be exercised, such a period, that it was not until the month of July that the necessary arrangements could be made for the commencement of this the most interesting of the charges of the Undersigned. The plans for the direction of the work of the season were all matured under the advice of the chief of the United States Coast Survey, our connection with which has been adverted to and mentioned in the preceding Report; and were so arranged as to meet, as much as possible, the common exigencies of both.

The primary object of importance seemed to be, the laying out of a certain and satisfactory connection of the triangles already executed on the coast, with those to be executed in Maryland; and accordingly, to that end the examinations and observations of the Undersigned were first directed. In establishing this communication, which, as is seen on the map, is direct between Wilmington and a point beyond the Delaware, a considerable step has been at once made; and the subsequent verification of the operations in Maryland, in any event, rendered easy and certain. The chain of primitive triangles was then continued south, as far down as the mouth of the Patuxent nearly, over an extent of more than 170 miles; and time has been spent so far without any decisive result, in order to effectuate a chain of points westwardly, through Charles and Prince George's counties, to the Potomac at Georgetown, where the highlands of the

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primitive range will render less difficult and more satisfactory further and future connections. In the district of operations, so far, great and peculiar difficulties have presented themselves, in the way of forming these connections in a proper manner. Except in one or two cases, the points are no where commanding; and in the counties south from Baltimore the high and level plateaus which characterize the face of the country, offer, in the but partial clearances which have been effected, obstacles almost insuperable, and calculated greatly to retard the hoped-for progress of the work. It is thought highly desirable to avoid, if possible, the erection and employment of scaffolds, to extend the view of the instrument and distance of the points; and, if the expense of their construction and the diminution of accuracy in their use be considered, it will be found more satisfactory, as well as expeditious, to take the requisite time for the discovery of points, when such exist, where the observations can be made from the surface of the ground. To this plan the Undersigned is desirous throughout to adhere.

While observing for the main triangulation connections, care was also taken to search for and select nearer points, fitted for secondary purposes. A few of the most prominent of these, on which signals were erected, have been indicated on the Map: the others have been noted, (in some cases signulized,) but left from the Map to avoid confused combinations. Enough has been done in this respect to warrant the employment of one or more Plane-table surveyors, early in the approaching season: the result of whose labors give the features of the surface of the country, and furnish the details to the Map.

The signals which have been made use of on the main points, are tin cones of considerable size, constructed in the same manner as those used heretofore in the United States Coast Survey, and are found to answer the best end. Those for the smaller triangles may probably be made in a different manner. In every case the stations themselves have been, and will be, marked in such a way as to render almost impossible any confusion, or loss of their respective positions. This is a matter of so much importance, in the ultimate utility of the survey, that it will continue to occupy the utmost attention; and no pains will be spared to make so exact the indications, that no other points of reference will after their establishment be needed for any purpose.

The situation and progress of the Coast Survey contributed to prevent the Superintendant from doing more in the co-operation of this season, than to visit all the points indicated on the Map; and become satisfied of their appropriate determination for his purposes, and to aid, with such advice and directions, as in many places materially to overcome the natural obstacles which oppose, over a large portion of the state, the execution of a satisfactory triangulation. This co-operation will be continued through the whole of the present season of activity, until permanent snows shall render reconnoitering, and the erection of signals, impossible; and in this manner, before the publication of this Report, it is expected that points on the Eastern Shore, corresponding in extent and position, with those of the Western, will have been selected and established.

The great difficulties in the reconnoisance every where hitherto, and more peculiarly in the districts of the Eastern Shore, where the operations are carrying on, have been before adverted to; and the Undersigned has thought it his duty to apply himself to the elaboration of some means which will facilitate this part of his work. He has reason to believe that in a modification of the ordinary air-balloon, which at a proper time will be submitted to the public, that requisite means will have been found; and it is his intention as soon in the coming spring as the necessary arrangement can be completed, to give, or at least attempt, the practical proof of the general utility of such an instrument, and of its applicability to the present and similar purposes. Although the practice of air-ballooning has been pushed to a wide extent, and as yet has redeemed very few of its original premises, he is of opinion that within certain limits its usefulness for geodetical objects (as has been already shown in military operations) is undoubted.

In thus giving an account of what has been so far done, the Undersigned would also report that the season for activity not yet being terminated, he is obliged to take as a limit what has been done to the 15th of this month. The operations are yet, and will be for some time longer, going on: and under these circumstances, he respectfully requests your Excellency's assent to an immaterial change which he proposes to make in the time of rendering his annual report. That document has hitherto

with convenience, been returned at the commencement of the session of the legislature. In the future, if it shall meet your Excellency's approval, it will be returned on the 1st of February of every year. The closet-work which is necesssary for the compilation of the Report, can in this way, be executed at a period which would be one of comparative official leisure; and the regular field work may be continued uninterruptedly to a season as late as the weather will permit.

Before concluding what he has to offer under this head, the Undersigned will add a paragraph in explanation of the printed Maps A. and B. which accompany it; the one being a geological map of Dorchester, Somerset, and Worcester counties on the Eastern Shore, the other a similar map of the counties of St. Mary, Charles, and a part of Prince George, on the Western Shore.

1. Besides containing the positions of the various places, the course of the streams, &c. and the geological indications, which speak for, and explain themselves; the Map A. contains also an elucidation of the topographical features of the country. There has been introduced into this, with as much general accuracy as possible, the system of horizontal planes, indicative of precise differences of level, as well as exhibiting to an eye but a little familiarized the contour and relief of the ground. The first and strongest line seperating the land from the water, is the line of mid-tide: the next line, more finely traced, and reaching all round the Map, by the Chesapeake, Choptank, and Atlantic, and crossing at some little distance above the head of tide in the rivers, is the projection of a plane parallel with the horizon, and situated four feet vertically above the surface of tide water; in other words, it exhibits the directions, which would be taken in tracing out upon the ground a level line through the whole country, starting at the height of four feet above the level of tide. In like manner the next line is the tracing of a similar level, starting at eight feet above the tide mark: the next is the tracing of a level line at twelve feet above tide water: the next sixteen, and so on: and in general, to ascertain the level of any point, i. e. its height above tide, it is only necessary to count the number of lines intervening between the said point, and the deep line of mid-tide mark: this number multiplied by four, will give the number of feet of elevation. All

s on the same line have the same level; and for what- number of lines that may intervene between any places, (counted always in the same direction, either wards or downwards,) there are just four times as many , in the difference of level, as there are lines.

he names of all important headlands have been given ar as known. As regards, however, the minor points hin the rivers, a general rule has been adopted in the ting of both Maps; not to give the name of one, un- there could be given the names of all, or unless re was some important particular in relation to it, ren- ing it desirable to express it minutely upon the Map.

On the extreme Eastern Shore the series of triangles, part of the work of last year, is exhibited; and the eement or disagreement shown of their geographical ults, with the best maps existing hitherto. The dif- ence appears to be enough to render more palpable n before the necessity of prosecuting throughout, a rk whose results can be relied on.

From the head of St. Martin river to the Pocomoke, nce to the Annemesic; from the Nanticoke to the Chi- nacomico, Transquaking and Blackwater, *red lines* in- ate the position of the proposed and desirable direc- ns for canals—which will thus unite together the com- ree of the whole peninsula and facilitate the drain- e and clearing of immense tracts of new and rich land.

The Undersigned has already heretofore expressed self fully, because he felt deeply, as to the peculiar ation and interest of the inhabitants of the eastern ge of Worcester county; who last year asked fruit- ly for aid to connect the waters of the Sound and p creek with those of St. Martin river, and ultimately the Delaware bay. One objection to their request ht have been made, that it tended to throw them in arms of Philadelphia, contrary to the supposed inte- ts of Baltimore. The answer might have been; not re than they were already thrown: but to the present nection, as exhibited on map A. no such local objec- n exists. A cut, as before proposed, from Trap to rring creeks, carries their produce into the St. Mar- . A canal thence conveys it into the Pocomoke—by ich, when improved, and a very short cut through land to the Annemesic, the entrance into the naviga- n of the Chesapeake bay can be at once assured. How

much this would tend to bind up interests whicl
been seen as if dissevered, and connect the remo
tions of the State with the vitality of the centre,
readily understood.

The connection of the Pocomoke and Indian r
thing heretofore ardently desired, and before thi
adverted to, is another arm thrown out for the co
tion of remote interests. The Undersigned cannot
that it will long be suffered to pass. The other i
ant combinations, by which the Nanticoke and Ch
are made one, derive additional influence, wher
known, that in all probability a Rail-road will s
constructed from Milford, on the Mispilion cre
Delaware, to Seaford, the head of navigation on th
ticoke. The facilities presented by this improv
will effect one or the other of two things: either th
coming down the Nanticoke at present will seek
er market through Milford—or, the trade of Milfo
Seaford must be made to take the safer inland ro
the Nanticoke and Choptank. It is not the busi
purpose of the Undersigned to argue the respect
vantages of the two results.

That the views expressed here and embodied
Map A. (which are not entertained by his colleag
himself only, but an active and intelligent portion
Eastern Shore,) are sound, the Undersigned may
cused for not doubting. He would equally expr
conviction, that it cannot be a great while befo
awakening feeling of this necessity of co-operati
tween legislative aid and individual and local eff
a civil polity, such as exists in Maryland, will spr
self also to the Eastern Shore; which has hither
ticipated but little in it. That it may soon so
is his earnest hope.

2. The same general explanations which, it is
have elucidated the mode of construction of Map
to be applied also to the other Map B. The prop
of the vertical scale are here however ten feet, a
pressed on the map itself, i. e. the number of lin
tween tide-water (which here also encircles the
and any required point must be multiplied by ten
the number of feet.

The localities of the deposites, which were g
the Map B. of last year, and which have been si

tended, are not here so minutely repeated; as indeed it would have been unnecessary. The extent of the various deposites coincides with the extent of the letters which indicate them; and they are now expressed under more general and comprehensive names.

The mode of execution of both maps (which is new, and consists in printing two different colors upon the same sheet) will be found, it is expected, to have diminished the possible confusion of their details, while it seems not to deprive them necessarily of any neatness in their appearance. They may be supposed to show, except in being not so carefully minute, the principles of execution and arrangement long ago laid down, as intended in the result of the whole survey.

In relation to the other Maps accompanying the Report, it may be added, in explanation, that in furnishing the reduced Maps for the use of the lithographer, it was not thought essential to the present purpose to exhibit more of the surveys for the Cape Charles and Lewes Canal than are contained, as already mentioned, in the Map A. whose eastern border exhibits the results of the larger chart. All the manuscript Maps belonging to that subject (from No. 1 to No. 6, inclusive, as referred to in this Report,) are deposited in the Council Chamber for the inspection of any who may find it a matter of interest to examine them. Lithographic copies of the other Maps, viz. of the Choptank and Blackwater Canal, the Piscatawa creek, and Allen's Fresh, being matters of extensive local interest (and that to many persons all of whom could not have an opportunity of referring to the manuscript Maps,) have been appended, it is thought, with propriety to this Report. It is supposed, that the titles of each will sufficiently designate them, and show to what parts of the Report they severally belong: and the numbers, therefore, which in the manuscripts and through this Report have been used, from motives of convenience to your Excellency and the Council, and for other reasons, have been omitted in the printed copies. No inconvenience or confusion from this source is at present foreseen.

With the same view of facilitating the understanding of the Report, and affording to every citizen an opportunity of seeing, in perhaps a better manner, something of the nature, extent, mode of execution and labors of a

trigonometric survey, the projection of the triangles laid out on the Western Shore has been made on a smaller scale than in the manuscript, and will also be printed to accompany this Report.

In this plan, the primitive triangle, embracing Baltimore and the Patapsco, (selected purposely because it contains the grounds of almost the only survey, and it is believed the first in the United States, based upon the proper principles and conducted by a skilful and scientific observer,) has been filled up with triangles of the second and third order, to show how the points are gradually brought nearer together—the nearer ones depending for their determination upon those, at first more remote, and partaking likewise of the accuracy with which these last mentioned have been established. In this way the entire work is seen to be of the same character—the same pains have necessarily to be taken at one place as at another—no error can be committed, against which there is not in the nature of the operation a check provided, or which will not, with attention, at once display itself in the want of a satisfactory arithmetical coincidence—and thus uniform features of confidence and certainty are stamped over the progress and completion of the whole. The arithmetical coincidence just adverted to, that the sum of the angular bearings of any three stations from one another, must be a precise number, and that always the same, imparts a stability, correctness, and harmony, which no other mode of surveying, chronometric or otherwise, can possibly pretend to. In the present case, the probable error in the determination of the place of any of the points, under all the precautions, cannot exceed one-fortieth of a foot per mile: the *satisfaction* (to call it by no other name) in results like these cannot but be appreciated by every citizen—not only by those who already understand something of the subject, but of those who now, for the first time, turn their attention towards it.

In the case of this Map, also as in the others, the manuscript number has been left from its margin, as its title appears to be sufficiently explanatory for its proper reference.

[illegible] till perder this, elligible favor of

After what has been said, the Undersigned might terminate here his Report, were it not that an object of great interest remains still to be submitted to your Excellency. This is a provision for the erection of a *State Observatory.* Although not indispensably necessary for the proper completion of the trigonometrical survey, it would furnish great and evident assistance, and would be found to increase in utility and value in proportion as the establishment itself grew older, long after the period when the labors of that survey shall have been closed. The fact of the importance of astronomical observations in one place, under the same circumstances, with assured regularity, and in a proper series, need not be adverted to here. The first advances towards civilization and the sciences were in the rude attempts to collect and classify knowledge in this particular—their latest acme will be illustrated by the efforts and success in its pursuit. Already, in Europe, the *moral force* of a government is estimated by what is done under its auspices to enlarge the sphere of acquaintance with facts: and if for us the prosperity of the Present is no inducement, a pledge of the gratitude of the Future is found in the affectionate reverence with which the memory of those especially is held, who in this branch toiled, under greater disadvantages, for the promotion of the very object here recommended.

The Undersigned solicits, then, the particular attention of your Excellency and of the General Assembly, to this proposition. He asks for it no more aid, of course, than its intrinsic worth seems to deserve: but it appears to him that, to every one who will take the trouble to make the comparison, the contrast between the amount expended and benefits gained will be very striking. Not many hundred dollars would be required to arrange the necessary apparatus, with the conveniences, for its earliest trials. The fruits of ten years' labor in that observatory would *sell* (if it is to keep a profit and loss account,) for five times so much—at the same time that it is exercising a moral influence incalculably more valuable.

The fact, that in this country there has been as yet no establishment of this kind, d that extensively indebted as our commerce is to the ·r·ous investigations and observations of citizens a ments [illegible] no effort has yet been made tow aymen[illegible]rs to

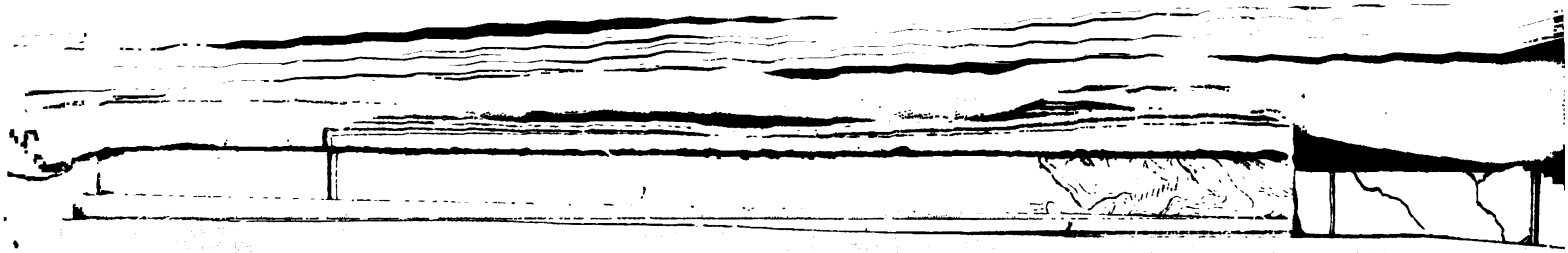
offer strong grounds for the measure; and the presen crisis seems not unfavorable for its execution. It ma be added, that by no member of our National Confede racy can the step be with more propriety taken than b Maryland; who has already, within late years, done s much by a discreet liberality to foster not only the re searches of pure science, but that happier union of Sci ence and Enterprise, which alone will render the on valuable—the other not unavailing.

Submitting now this Report, the Undersigned ha only to express his hope that some of its suggestions ma be well weighed before being decided upon; and to offe to your Excellency, in its conclusion, the assurance o the entire respect with which he has the honor to re main

Your Excellency's
Very obedient servant,
J. H. ALEXANDER.

Baltimore, 29th December, 1835.

S T
Public Land
Great Bay P
Rogged P



REPORT OF THE GEOLOGIST.

To his Excellency

JAMES THOMAS,

Governor of Maryland:

IN pursuance of the duties assigned to the Geologist of the State, the Undersigned acting in that capacity, has the honor of submitting to your Excellency the result of his researches for the past year.

It will be remembered that the final intention of the survey is, to furnish to the officer now engaged in preparing a Topographical and Geographical Map of the State, on the accomplishment of his work, with a complete and minute Geological account of the whole State, which will enable him to indicate upon the New Map the localities of valuable mineral deposites, as well as to exhibit correctly, the limits of the different Geological formations that compose the territory of Maryland. Accordingly, the Undersigned has never lost sight of this final object of his investigations, so that it has been his constant care to collect as much information in this respect as possible: and he flatters himself that he has succeeded in acquiring all the knowledge desirable, of such portions of the state as have been already traversed, and over which Geological surveys have been completed. But it cannot be expected of him to make those results fully known at present, because there remains another important step to be taken, namely: to connect the results of observations made in one section of the country, with those in another; by which many generalities of consequence may be extended, corrected, improved, or modified. It is not necessary to be conversant with the subject, to perceive the necessity of becoming well acquainted with every part of a system of formations, before any comprehensive description of such a system can be given. Nor has it been in the power of the Geologist

to adopt and pursue a plan of operations more in accordance than the one he has followed, with this apparently most desirable mode of proceeding; his instructions having been virtually, to cause the strict demands of science to yield to the paramount considerations of public favor and utility. Hence it has not unfrequently happened, that whilst pursuing with great personal interest, a series of observations, a sense of public duty, and a desire to render more immediately available some important suggestion, have compelled him to obey calls upon him to set on foot new inquiries in other districts. Thus, whilst endeavoring to determine the exact limits of the three tertiary periods that occur within our territory, and partly extend over both shores of the Chesapeake bay, having received specimens of a valuable material, forming part of the secondary formations, it was deemed advisable to repair to this new field of interest, to expedite the benefit that might be derived from the discovery: some advantage being moreover expected, by directing the researches of those interested in it, preparatory to the future more minute investigations.

For these reasons, no attempt is yet made to assign the precise limits of the tertiary deposite in Maryland: but in reference to the determinations already made by an experienced naturalist of a neighboring city, (Mr. Conrad, of Philadelphia,) it may be well to remark, that the *eocene*, or oldest of the tertiary periods, observed by him at Fort Washington on the Potomac, at Piscataway and at Upper Marlborough on the Western Branch of the Patuxent, has been traced to the main branch of the same river, at Queen Ann, and crossing South river, it has been found to reach within six miles of Annapolis. In an essay, entitled "Observations on a portion of the Atlantic Tertiary Region," published in the transactions of the Geological Society of Pennsylvania, Mr. Conrad remarks: "It has been stated by Professor Ducatel, that green sand, of the age of the New Jersey marl, exists in Maryland; but I believe that, so far as organic remains will determine the point, it will all prove to be of lower tertiary origin." This stricture, it is presumed, can only be intended to refer to what was stated in the Report of last year, as to the occurrence of a formation in Charles county, answering in almost every respect to the description given by Professor Rogers of one in Vir-

ginia, which was referred by that gentleman to the period in question—one of the characteristic fossils of the formation being the *gryphœa vomer*. In speaking of the deposite at Upper Marlborough, Mr. Conrad says: "The only secondary species (of shells) observed here, is the gryphœa vomer, (Morton,) but as the matrix is merely the detritus of the secondary green sand, it may be entirely accidental," &c. It remains then to be determined how many occurrences of the kind are to be deemed mere accidents: but there can be no objection for the present, to accede to Mr. Conrad's views, and accordingly the formation in Charles county is referred, on the Map B accompanying this Report, to the eocene period, and is designated as *Eocene marl containing green particles*. The occurrence of green sand "of the age of the New Jersey marl," in Maryland, has since been satisfactorily ascertained. It is found in Kent and Cecil counties at the head of the Sassafras river; and determining from mineralogical characters, the deposites at, and around Annapolis, are confidently referred, as Mr. Morton had been previously led to do from information, to the same epoch. It is moreover believed, that some of the members of the green sand formation have been discovered in the Potomac counties of the State, intimately associated with deposites usually referred to a more recent period. But we should be cautious not to arrive at general conclusions too hastily.

As stated in the Report of last year, no deposites of the *miocene* period have so far been discovered in Maryland. The fossil deposites of the *older pliocene* formation are found in the greatest abundance in Saint Mary's and Calvert counties, on the Western Shore of the Chesapeake bay. They are in the greater portion of this district, covered by a thick bed of diluvial gravel and sand, but never fail to make their appearance in the deep ravines that intersect the country bordering in St. Mary's county, on the Patuxent. They may be said to form the substratum indeed, of this county on the Potomac side, from the Wicomico to the St. Mary's river; and on the Patuxent side, from Benedict to Town Creek. In Calvert county, from the Cliffs to Plumb Point, we find an almost uninterrupted deposite of the older pliocene marls. Those of the Eastern Shore of Maryland,

were described in last year's Report, as occurring in numerous localities between the Chester and the Choptank.

Mr. Conrad refers the deposite near the mouth of the Potomac, at Cornfield Point, to the *newer pliocene* æra, as also one at Easton, on the Eastern Shore. A third deposite of the same period, occurs at the head of tide, on the north-west fork of the Nanticoke, forming the extreme southern limit of the fossiliferous deposites above tide, on the east side of the Chesapeake bay.

Until farther information be obtained, and the geography of the country more specially determined, it is not thought advisable to assign the limits of the geological formations of Maryland, even as far as these appear to have been ascertained. The subjects of interest growing out of the survey, refer at present to the resources of any kind that present themselves, and are of importance to be known, not only to those who possess them, but to the citizens of the State at large. It was one of the principal objects of those who projected the survey, and it seems also to have been the intention of the enlightened Legislature which ordered it, that it should be the means of developing all the advantages, and the whole riches of the State, for the benefit of every portion of her population. In this spirit, the officers charged with the undertaking have sought to collect information on every subject connected with the physical geography of the country.

Whilst endeavoring to pursue their researches according to the true principles of scientific investigation, they could not be satisfied with merely stating the result of their labors, without pointing out the uses that may be made of them, as subservient to the various interests of their fellow-citizens. The reports which they are called upon annually to submit could not be satisfactory, did they relate solely to an announcement of the progress of their work. The account must embrace considerations of practical utility, immediately or remotely applicable. And viewing the project as a comprehensive scheme of internal improvement, they are proud to have it in their power to devote all their energies to its completion; venturing to assert, that when the task is accomplished, the advantages accruing from it, in the very nature of the

work, will become manifest to every one. The reports of the preceding year were drawn out in this spirit; that of the present is respectfully submitted, under the same impression of superior individual and public good, consequent upon such a course.

In giving an account of the researches of the past season, the subject will be divided in reference to the districts of country that have been examined, beginning with the southern counties on the Eastern Shore of Maryland.

SEC. 1. *Geological Examination of Dorchester, Somerset, and Worcester counties on the Eastern Shore of Maryland.*

These three counties, comprising more than one-third of the territory of Maryland, east of the Chesapeake bay, though presenting but little variety in their mineralogical and geological features, are yet not devoid of interest in these respects, while in others they offer subjects of consideration of the deepest importance to the prosperity of the State.

The most prominent geological feature in this district is a succession of sandy hillocks, in what are termed the upper portions of these counties, being a continuation of the ridge dividing the courses of the waters that empty themselves to the east into the bay of Delaware, and to the west into the Chesapeake. These hills of sand are themselves arranged in ridges, running generally north-east and south-west, diminishing in elevation towards the southern extremity of the peninsula, forming a curve on its eastern boundary, and presenting every appearance of a series of sandy beaches produced by successive retreats of an ocean. No organic remains of any kind are known to have been found within this portion of our territory, excepting a deposite of oyster shells at the head of Taylor's creek, two miles above the fork of the Nanticoke, and ten miles below the fossiliferous deposite occurring on the north-west branch of this river, and previously referred to the newer pliocene formation. This deposite is overlaid by soil six feet in depth. The shells contained in it are much in the same condition as those occurring in the accumulations supposed to have been made by the aboriginal inhabitants of the country; i. e. the valves are separated, and are not, so far as perceived,

associated with any other marine shells. They are, however, perforated and covered with *serpulæ*, as if they had lain long, after the death of their inhabitants, at the bottom of the sea. But they are a great distance from any actual oyster beds, and are in a more advanced state of disintegration than the fossil oysters heretofore observed; whilst, on the other hand, they are covered, as aforesaid, by a thick stratum of sand, no where else remarked to overlie Indian banks.

The lower portion of the peninsula lying in Maryland, embracing Dorchester, Somerset, and Worcester, is a low level country: mostly a deposite of stiff clay, excepting on the margin of the rivers and creeks, where the country is wavy and the soil sandy. The sand hills, on the borders of the rivers, are always situated on their south or south-eastern sides, and extend but as short distance inland. In some instances they form distinct ridges or waves of sand, running in various directions; sometimes parallel with the course of the river, and when occurring at the extremity of necks, transversely, or across the points. The intervening necks, sloping gently to the south and south-east, terminate in extensive marshes, which in high tides are frequently entirely submerged. In the midst of these marshes there are occasional sand hills, or hummocks; but rarely of any great extent.

The sameness in the geological constitution of the necks of land, just referred to, is evinced in the digging of wells, from which this section of country is exclusively supplied with water for domestic purposes. At a depth of from ten to twelve feet, penetrating through the stiff clay, there is invariably encountered a stratum of clean white sand, with gravel varying from one to two or three feet in thickness. Out of this an abundant supply of good water can be obtained; but beneath it there is always found a soft black mud, with an offensive odor, and filled with decayed vegetable matter, composed principally of a coarse grass, similar to that growing upon the present marshes. In some places this mud is reported to be of great depth. It does not appear, however, to have ever been accurately sounded; but in one instance, already alluded to in a previous report, at Cambridge, it was traversed, and is stated to have been found overly-

ing a fossil deposite, the shells of which are referrible to the older pliocene marls.

Another remarkable feature in the geology of this country is the occurrence of a ledge of water-worn stones, composed of quartz and sandstone, constituting gravel and boulders of various sizes, from twenty to several hundred pounds in weight. These stones were first observed between Todd's point and the head of Little Choptank; they were afterwards found scattered over a narrow zone of land, between Monie creek and the Manokin. They are said to occur at the head of Back creek, on the south side of Manokin, and were finally again observed near the mouth of Marumsco creek, on Pocomoke bay. At this last mentioned spot—being a knoll of dry ground in the marshes, protruding into the bay—the beach is covered with these stones, washed out of the bank. All of them are a close grained sandstone, with small veins of quartz, the sandstone being of the character or that occurring on the Blue ridge, different from that constituting the *white rocks* at the mouth of the Patapsco, but similar to those larger masses that are found strewed over the surface in the upper parts of the Eastern Shore of Maryland, in Cecil county. These erratic masses form, with the exception of the bog iron ore—which will be presently more particularly referred to—the only stony bodies that occur in the three Eastern Shore counties, now under examination.*

Such are the great geological features of this section of country. A more detailed account of its physical geography will now be given under separate heads, for each of the three counties embraced within it.

Dorchester County, lying between the Choptank and Nanticoke rivers, requires perhaps more than any other county on the Eastern Shore, the assistance which would necessarily be afforded by an accurate topographical survey, in adopting measures to bring into operation her natural resources. Placed between two large rivers, her facilities for sending the produce of her soil to a market are yet not great, and mostly confined to the least productive part of her territory. The central portion of

*A ledge of submarine rocks is said to be off Todd's point, and another off Benoni's point, on the Talbot side of the Choptank.

the county, most susceptible of great and permanent improvement, and even at this time the most productive, is deprived of an outlet for her agricultural staples, corn and wheat; and the no less valuable source of wealth, which she possesses, in her magnificent growth of timber. The natural channels of egress through the Blackwater and Transquaking have long since failed to be available in any thing more than a limited degree, these rivers serving now rather to increase the obstacles to the navigation of the bay into which they empty. Fishing bay, their common estuary, offers scarcely more than five feet of water, at high tides, over a deep and extensive mud flat, which it is utterly impracticable to remove.—The inconvenience arising from this cause is felt by a large portion of the county, and has suggested the application to the Legislature, for the opening of a canal communication between the Blackwater and the Choptank. Such a canal would but partially remedy the inconvenience, whilst a more comprehensive view of the benefit to be derived, points to the practicability of connecting the Nanticoke with the Choptank. This is believed to be entirely practicable, and the advantages to be obtained from the connection of these two rivers by means of a canal, traversing the heads of navigation of the Blackwater, Transquaking and Chicamacomico—a project to be effected at a trifling expense—are great and obvious. A communication of this kind would not only furnish an outlet for the already valuable products of the county, but could be used as a means of conveying to it those materials, such as marl, lime, &c. (of which an abundance would be thus brought within a convenient reach) that are necessary in order to enhance the productiveness of its soil, and bring it into that state of improvement of which it is susceptible. Other advantages may be expected to accrue from the excavation of a canal in the direction just referred to; among which, not the least important would be to render it subservient to the effectual and thorough drainage of a large extent of country, at present uncultivable, and not only itself insalubrious, but the main cause of the unhealthiness of that by which it is surrounded. It would seem to be at all times a subject worthy of the attention of a government that wishes to increase the quantity of nutriment, as well as to improve the salubrity of a country, and consequently to

augment its population and prosperity, to employ suitable means to effect a complete drainage of every morassy district, within its dominion, of whatever extent. In the present case the proposed improvement forms, however, only part of a scheme of internal navigation that might, is believed, be advantageously pursued for the benefit of a large portion of the Eastern Shore of Maryland.

In the upper part of Dorchester county the soil is mostly a sandy loam, well adapted, with proper management, to the growth of corn, rye and oats This character of soil belongs more especially to those portions lying on the rivers, and extends, with very few exceptions, over a narrow slip of land on the Choptank, as far as Hill's Point, on the bay shore. The neck between the Big and Little Choptank is a low flat country, mostly composed of a stiff clay soil, covered with a plentiful growth of pine, sweet-gum, oak and dogwood, but suffering greatly from a want of convenient drainage; an evil that might be remedied, and by which thousands of acres of land, now of little value, would be reclaimed and rendered fit for cultivation. With the advantages possessed by this section of country, in her now extensive deposites of shells on the river banks, her sea ooze, together with her proximity and easy access to the marl deposites of Talbot county, it ought to become one of the most productive and flourishing portions of the State.

The necks and islands, forming the western and southwestern portions of the county, likewise present us with low level lands and a stiff clay soil, mostly well timbered with pine, white, black, and willow oak, sweet-gum, &c. The situations on the islands are delightful and generally reputed healthy.

Meekin's Neck, on the bay shore, is marshy, and this is the case of nearly one half of Hooper's Island, the extent of which is nearly fourteen miles in length, and from one to two in breadth: such portions of the island as are arable have a productive soil. At the head of Honga river and bay there are extensive meadows; and where the soil, also a clayey loam, is cultivated, it is said, to yield abundantly. Bishops head Neck offers the same character of soil and physical aspect. Throughout the whole of this district the depth of wells is rarely

found to exceed ten feet, penetrating the clay to sand, from which the water issues, seldom perfectly clear, and occasionally slightly brackish.

At the heads of big and little Blackwater rivers there are also extensive marshes; the country is very level, low and swampy; the soil a stiff clay; timber principally oaks and sweet gum. Between the Blackwater and Transquaking, around Buckstown, the country is more elevated, the soil lighter, with a growth of very large oaks and American poplars. The wells here are sunk to the depth of 12 feet, through clay, reaching gravel and sand.

Towards the head of the Transquaking, and between it and the Chicamacomico, the soil is a clay-loam, that would yield very good crops of grain, if properly improved. Beyond the Chicamacomico the country is more uneven, the soil lighter, sometimes sandy, the level of the country rising towards Vienna. Wherever the soil is stiff it is covered by a heavy growth of oaks and gum.

Hurley's Neck, along the Nanticoke, south of Vienna, is a level stiff clay, well wooded, for the distance of about seven miles, after which it terminates in an extensive marsh.

No fossil deposites, similar to those occurring so abundantly north of the Choptank, have been discovered in Dorchester county, that would answer for agricultural purposes; but the large accumulations of shells found at Horn Point, at Oyster-shell Point, and other places, together with the deposite on Taylor's creek already referred to, might be made eminently serviceable if burnt into lime. The only mineral formations of any value are the deposites of bog-ore, at the heads of Transquaking and Chicamacomico, and on Reedy creek, in the vicinity of Federalsburg. This ore is compact, heavy, free from phosphate of iron, and would probably yield from 40 to 50 per cent. of good metal. Some inclination having been manifested by an enterprizing proprietor, of an extensive deposite of ore, on the Chicamacomico, to work it in place, it was thought more advisable to recommend that it should be forwarded to the Baltimore market, where it would probably command from $3 to $4 a ton.

Somerset county presents, in its physical geography, as might have been expected, great features of resemblance

with the county that has just been described. Its upper portions are very sandy and rolling—a succession in fact of sand hills, gently inclining to the south, and terminating in a level deposite of stiff clay—as if at one time this part of the country had been a sea beach, from which the waters have receded to a considerable distance beyond the mud flats that formed at the same period of time the shallow bottom of the ocean, and extended several miles from her shores. But what is here supposed to have been formerly an extensive mud flat, is now a populous country, in many places well cultivated, every where very improvable, possessing a productive soil, well timbered, and intersected by numerous creeks and rivers These form the *necks* of the county, falling by an imperceptible slope into marshes many miles in extent, with here and there a hummock, crowned with some lofty pine, or a herd of grazing cattle looming against the horizon, to relieve the monotony of the scenery. The waters of the sound, by which these marshes are limited, are not seen, unless perhaps from the top of some hummock, and are only indicated by the occasional passage of some skiff, whose white swollen sails contrast agreeably with the luxuriant dark-green growth of these grassy plains.

Without having reason to believe that the waters of the Chesapeake bay have absolutely diminished, it is nevertheless true that the amount of dry land is increasing on the Eastern Shore of Maryland, by the filling up of creeks, rivers, and small bays, at the confluence of its muddy streams. The flats of Fishing bay and Pocomoke bay furnish us with examples of this, upon a sufficiently large scale, to produce, in no great lapse of time, very remarkable changes in the geography of this part of our territory.

That portion of the neck of land lying between the Nanticoke and the Wicomico, and continguous to the former river, is within a narrow stripe, wavy and sandy, inclining moderately to the S. E. and terminating in marshes. The intervening country is level, with a stiff clay soil; this being the character, as must already have been perceived, of all those portions of the Eastern Shore, comprised within what are termed the necks. Generally speaking, the N. and N. W. parts of these necks, extending along the rivers and creeks, have a

light soil; in the central portions the soil is clayey, and the S. and S. E. extremities are marshy; such is the character of Hungry neck, between the Wicomico river and Monie creek, and the description will answer for Manokin neck; though in this there does not appear to be the same uniformity in the character of the clay, which varies from a white and yellow stiff clay to a black clayey loam, equally various in its degrees of productiveness and in the kinds of crops which it can be made profitably to yield. The upper parts of this neck are covered with manigficent oaks, sweet gums, maples and beech; the lower portions support a growth of lofty pines, with an undergrowth of holly and sweet gum, and verging upon the marshes, that extend across the neck from the Wicomico to the Manokin, the pines are small, probably new growth. The soil of the lands that terminate the neck—big and little Deele's islands—on the north-west side, is a sandy loam, very productive in corn and sweet potatoes.

The aspect of the country between the Manokin and Annemessex, presents us with the usual almost dead level of clayey soil, covered partly with oaks, sweet gum, maple, &c. the pine predominating towards the lower end, and on approaching the marshes, the timber having been in a great measure destroyed, there remains but a scanty growth of small pines. The extensive marshes, called the Jericho marshes, form the extreme end of the necks, on the borders, and in the midst of which, are some few inhabited spots, more remarkable for their great salubrity, than, as might perhaps have been supposed, for the dreariness of their situations. To become convinced that health and comfort are sometimes found where they are very little expected, it is only necessary to pay a visit to the hospitable residence of Captain Davy, at the head of the salt marshes of Jericho.

Annemessex neck, whose soil and appearance would require the same description as that already given of similar portions of the country, is thickly settled towards the lower end, by a hardy population of boat-builders and boatmen; the latter supporting themselves principally by the sale of oysters, clams, and terrapins. These

men may be instanced as further evidences of the healthiness of the marshy districts of country upon salt water. Whatever may be the influence of these marshes at a distance, judging from the appearance alone of those who inhabit them, or constantly frequent them, they are not the seats of disease; for it would be difficult, in any other section of our country, to find a more hardy and robust set of men, than the residents on the little Annemessex, and yet it is not to all, that the praise of unexceptionable habits can be extended.

From the head of little Annemessex, the eye looks over a broad expanse of salt marshes, reaching to the southern limits of our state—Watkins' Point, being lost somewhere among them. Bounding these marshes to the north, there is a well wooded country, with a good soil and highly improvable, extending to the Pocomoke bay and river, and comprising the district of Rehoboth. Marumsco neck, towards the latter district, is also well wooded, the country level, and the soil generally clay loam, in some places at the head of creeks more uneven and sandy.

Such is the account, and it will, it is believed, be found substantially correct, that may be given of the lowest portions of Somerset county. It has already been said, that the northern part of the county is sandy. It is especially so between Barren creek and Salisbury; but from Barren creek, in the direction of Quantico, to Whitehaven,the soil passes from a sandy loam to the stiff clay bottoms, described as forming the principal soil of the necks. Along the Wicomico river, on either side, the soil is mostly sandy. On the eastern side of this river, and reaching from it towards the south, the soil varies from sandy, sandy loam to clay loam; and a northerly direction from Princess Anne to Salisbury leads successively over clay, clayey loam, sandy loam, and through a swampy district, to the sand ridges of the upper portion of the county.

The only mineral product of Somerset county is *bog-ore*, of which there is an abundant deposite, of excellent quality, at the head of Barren creek. It has been raised in considerable quantity, and continues to be profitably extracted by Mr. Brattan, who delivers it at Baltimore for $3 the ton. A large supply of this ore might be obtained from this and other neighboring localities. It is

also found at the heads of Back and Dividing creeks, but samples examined from these places indicate an inferior quality of ore.

The mineral springs of Barren creek deserve more attention than they have lately received. These waters have been analized, and were found to contain oxide of iron, soda, and magnesia, combined with muriatic acid. They belong therefore, to the class of alkaline chalybeates, are tonic and diuretic, and have been found eminently serviceable in bilious disorders. The well known curative properties of the waters, the comfortable accommodations at the springs, with the obliging disposition of the proprietor, and of the tenant, Mr. Levin L. Porter, ought to furnish strong inducements to invalids of the Eastern Shore of Maryland, to resort to them now, as they were wont to do in former times.

No fossil deposites answering as marl have been found in Somerset county; but a material almost as valuable occurs abundantly in various places, constituting those accumulations of oyster shells, believed to have been made on the site of ancient Indian settlements. The spots upon which these shell banks were observed, are, on the Nanticoke, at the mouth of Witipquin creek, and at the Sandflea Landing; on the Wicomico, at Long Point, where there occurs one of the most extensive banks of the kind known, the shells therein, being deposited at the depth of from three to nine feet, extending nearly a quarter of a mile along the shore, and several hundred yards inland; on the Manokin, Maddox island and Fishing island are covered by similar accumulations; and on the Pocomoke, another occurs at Shelltown, about two miles above the mouth of the river. Banks of the same kind are found in other places, but of a more limited extent.

The value of this material has already been stated in a preceding report, but it cannot be too strongly impressed upon the farmers of the lower counties on the Eastern Shore of Maryland. *It is the principal agricultural resource which they possess, by a proper application of which they may double the produce of their lands.* In the upper counties of the Eastern Shore, where the worth of the material is appreciated, it is made to undergo two operations: it is passed through a coarse sieve, in order to separate the black highly fertilizing mould with which the

shells are associated, and the fine fragments of these; the coarse clean shells are then burnt into lime. The sifted article readily commands from three to four cents a bushel: the lime sells at from six to nine cents, according to its quality. By referring to the section "On the comparative value of shell lime and stone lime," your Excellency will perceive that the difference in value, between the two articles, for agricultural purposes, is very trifling, whilst the difference in price is considerable. Can any farmer doubt that the discovery on the Eastern Shore, of limestone quarries even of moderate extent, and to be used solely for the conversion of stone into lime, would be of immense benefit to the country? The equivalents of such quarries are found in the shell banks that have just been indicated. They should no longer be neglected.

Worcester county has long felt the want of some parental assistance, to enable her to bring fully into action her natural resources. She has asked for three capital improvements, of which two have been reported necessary and practicable; viz. the cleaning out of the Pocomoke river, so as to render it navigable for flat-boats, at least about fifteen miles above where it is now available, or seventeen miles beyond Snow-hill, at present the head of navigation; and a canal communication between Sinepuxent bay and the Delaware. To understand the value of these improvements, it is necessary to possess an outline of the geography of the county.

This county is bordered on the east by the Atlantic ocean; but between this ocean and the cultivable portions of the county there is a prolonged sandy beach, varying from a few hundred yards to a quarter of a mile and upwards in breadth, and extending the whole length of the coast without a single outlet to the sea, from Indian river, in Delaware, to the southern extremity of Chincoteague island in Virginia. Between this beach and the main land lies Sinepuxent bay, from one to four or five miles wide, and nearly thirty miles in length. It is a shallow sheet of water, navigable only to a short distance above South point, at the lower end of Sinepuxent neck. The entrance to the bay is reputed to be also very shallow. Sinepuxent neck, about ten miles long, lies between Assateague or Trap creek and Sinepuxent sound, at the head of the bay. The produce of this neck, and of the

country on the Assateague, which, comprising the Berlin district, are amongst the most flourishing portions of the county, has thus to be sent down a long bay through a difficult entrance, to encounter finally the dangers of an ocean navigation in search of a market, whilst an easy, short, and safe transportation could be readily obtained. To effect this latter object, it has been proposed to connect Trap creek by the St. Martins and Indian rivers, with the Delaware bay, inside of cape Henlopen. The surveys for this substantial improvement have been made, and its easy accomplishment, at a moderate expense, demonstrated.

The other improvement, solicited by Worcester county—the clearing of the Pocomoke—has likewise been found to be practicable. Viewed in connection with the canal communication just referred to, it acquires more importance than is at first sight apparent. The Pocomoke river rises in an extensive swamp, situated partly in Maryland and partly in Delaware, called the Cypress swamp, from the profuse growth of this valuable timber, by which it is covered. The bed of the river, now obstructed by large trees, lying across it in every direction, passes through the heart of the county, dividing it into two nearly equal portions. Owing to the obstacles presented by the fallen trees into its bed, its downward navigation commences only a few miles above Snowhill, after which it is free for schooners over a distance of about twenty miles, to the mouth of the river in Pocomoke bay, on the Chesapeake side of the county. It has been proposed to remove these impediments as far up as the use of the river is found to be impeded by this cause; and the advantages to be thence derived are shown to be considerable. It would facilitate the access to a vast body of valuable timber, and to extensive deposites of iron ore of good quality; and by confining the waters of the river within their natural channel, it would effect the drainage of a large tract of land, now an almost impenetrable swamp, covering doubtless a rich and fertile bottom. These are interesting considerations, whose importance becomes enhanced by the fact of the practicability of farther connecting, by a canal navigation, the head waters of the Pocomoke with the St. Martin river, and its projected communication with the Delaware, thus

establishing a complete thoroughfare through the county, from one bay to the other.

But to render this project of internal navigation complete, another improvement seems to be required. The mud flat in Pocomoke bay, already alluded to, forms, as is well known, a serious impediment to the free egress from the mouth of the river, through the sound into the Chesapeake, and the inquiry has been made as to the possibility of removing it. Attention having been turned to the subject, the removal was concluded to be quite impracticable, as well from its nature as from its extent; being the natural effect of causes, that, as they cannot be removed, would be constantly giving rise to the same results. Whatever remedy might be partially applied would be therefore but temporary, very expensive, and would do but imperfectly, what, it is considered, can be accomplished in a more permanent, less costly, aud more efficient manner, in another direction, namely: by connecting the Pocomoke with the Annemessex—a project which has already met with the approbation of the Legislature, and for the performance of which an adequate sum of money has been contingently appropriated.

As this project was brought forward by an honorable Delegate from Somerset, it shows that this county is equally interested in it, as she is in another direction with the proposed connection of the Nanticoke with the Choptank. Viewing these projects connectedly, it will be seen that they are intended to establish an internal communication of some extent, calculated to bring into full operation all the resources of the country through which it will pass, enabling it to send its products to a market by the shortest route, and facilitating to it the means of obtaining the materials necessary for its improvement. Some advantages would likewise be derived from it in case of war, upon which the belligerent spirit of the times compels us unfortunately to calculate as a possible event, by providing against the almost total non-intercouse between one section of the State and another. It forms a part of the duties of the Undersigned to report to your Excellency, that the geological constitution of the country is highly favorable to the easy accomplishment of these projects.

The agriculture of Worcester is not in so favorable a condition as it might be brought to with a little more

exertion. The soil is alternately sand and clay, or a mixture of both in variable proportions, and entirely deficient in calcareous matter. On the western side of the Pocomoke, the upper portions of this district that are not swampy, exhibit a succession of sandy knolls and ridges, with occasional basins, as it were, of level land, composed of stiff clay. The growth is principally pine and sweet gum; but on the branches, and in the swamps, there is seen a profusion of alder, maple, magnolia, kalmia, with the cypresses, of which two species were observed—one deciduous, called the bald cypress, the other an evergreen. Between the Naseongo and Dividing creeks the soil varies from almost pure sand to a sandy loam, rarely, though sometimes clayey: the pine and sweet gum form the principal growth upon it. Along the margin of the river the soil is very sandy.

East of the Pocomoke the country is more swampy, the runs that feed the river, being principally on this side. It is covered by a heavy growth of oak and cypress, and when cleared and drained shows a stiff clay soil. On some portions of the newly cleared land a young growth of papaw was observed, and in some places the less auspicious persimon makes its appearance. Receding from the river the country is gently elevated, forming a low dividing ridge between the feeders of the Pocomoke and the waters of the St. Martin river and Sinepuxent bay. This ridge-land runs north and south, in the direction of the main road through St. Martins, Berlin, and Newark. Sinepuxent neck is a level track of land, with a soil varying from sandy to clayey loam, occasionally passing to a stiff clay. The middle portion of the neck is tolerably well wooded; the extreme end, towards South point, has been stripped of its timber. This, the Berlin vicinity, and the St Martin district, are amongst the most flourishing parts of the country.

From Newark to Snowhill, on approaching the river and town, the soil becomes very sandy; and proceeding southwardly, as far as Newtown, the soil passes over a succession of sand hills, barely possessed of a soil. Towards the extreme end of the county, continuing along the Pocomoke, the country is more level, with a more substantial soil, said to yield good corn crops, and is much better wooded,

Crossing the peninsula in the direction of the dividing

line between Maryland and Virginia, the country, at first level, soon appears gently undulatory, with a mixed soil, frequently a stiff clay, to within two or three miles of the sea side, when it becomes decidedly hilly; occasionally well wooded with pine, oak, hickory, and dogwood, having a good loamy soil, that could be made very productive in corn and oats. This seaside, as it is called, is an uneven country, stretching along Sinepuxent sound, descending to it occasionally by a gentle slope, and sometimes encroaching upon it in the shape of extended marshes. The ridge-land, between the sound and river, is more level, soil more clayey and equally improvable, but no where in a good state of cultivation.

Sinepuxent bay or sound, to which reference has so frequently been made, forms a very important feature in the physical geography of Worcester county. The Map A. appended to this Report, and furnished for its illustration by the Topographical Engineer of the State, exhibits its actual appearance contrasted with that it bears in the maps and charts now extant. Its condition, as a navigable sheet of water, has been fully described in the "Report of the Commissioners of the States of Delaware, Maryland, and Virginia, for the survey of the sounds between Cape Charles and Cape Henlopen," submitted last year to the General Assembly of Maryland. For present purposes it is only necessary to consider it as a narrow and shallow sea, interspersed with broken marshes and shoals, composed of oyster shells, mixed with clam, scallop and other marine exuviæ. It is interesting in a geological respect, and not a little so, as will immediately be shown, for the agricultural resource which it actually does and can more extensively be made to yield.

It is an interesting fact connected with the past and present condition of Sinepuxent sound, that since the closing up of some inlets admitting the ocean into it, its waters having thus become comparatively fresh, the oysters and clams, by which they were formerly thickly inhabited, have died, leaving extensive beds of their exuviæ. These accumulations of shells, or *oyster rocks*, as they are here termed, seem to point at the manner in which similar deposites, now far inland and constituting the shell-marl deposites of other districts, have been made. They are evidently the quiet and gradual accu-

mulation of years, covered by a deposition of sand or mud, varying, according to circumstances, with the altering condition of the country where they are now found, and in some measure serve to explain the mode of formation of our fossiliferous beds. At no very remote period of time, they will probably furnish the prototypes of a geological formation, hitherto undescribed and characterized by the presence of a new species of zoophytes. In their present state, these oyster rocks afford an abundant supply of a very valuable material, already put to good account, but that ought to be much more extensively employed. They are now dredged, and their contents, consisting of oyster shells, clams and other marine shells, incrusted by a zoophytic production which has received the name of *Bunyan*, are burnt into lime. From this source not only an important and profitable branch of industry is created, but an invaluable product obtained for the improvement of the whole of Worcester county. The question has been asked, whether the lime obtained from this source is good? It may at once be answered, that it is as good as from any other quarter; but a more satisfactory reply will perhaps be found in the third section of this report. Indian shell banks also are found on Sinepuxent neck where they have been partially applied, and always with the best results, which ought to be an encouragement to their more liberal employment.

The mineral product of Worcester county is confined to the bog-ore, occurring abundantly on the Naseongo, where it has been worked with variable success, being unfortunately too much mixed with phosphate of iron. A deposite of ore of better quality has been discovered on the Pocomoke, in the fork between this river and Duncan's mill branch, and it is again met with in the swamps around Newtown.

A more general view of the application that can be made of the knowledge so far acquired, respecting the physical geography of the three counties just described, remains now to be taken.

Sect. II.—*Agricultural resources of the lower counties on the Eastern Shore of Maryland.*

The agricultural improvements of Dorchester, Somerset and Worcester counties, fall far short of what they

might be made to attain, by a better system of cultivation, and a more liberal employment of the resources which this section of the state possesses. But to effect a thorough improvement, the attention should be first directed to the congeniality of the soil, in each district, for that species of growth from which a crop is expected. Corn and wheat are the staple commodities of the Eastern Shore, but in the present condition of things, the latter is so precarious a resource, that corn may be said to be the principal produce and main dependance of the lower counties. And yet their various soils are capable of producing a number of other crops: rye, oats, beans, potatoes, (common and sweet,) and the root crops generally. But it is not only in limiting the variety of their crops, that the agriculturists of this section of country err; they neglect to take into account the peculiar susceptibilities of the various kinds of soil, to produce certain crops in preference to others; and thus an injudicious system of husbandry is followed, resulting most frequently in disappointment. On some of the light soils described as belonging to the upper portions of these counties, wheat cannot be raised, whilst these same soils may be made to yield profitable returns of corn, rye, and oats; it is therefore worse than useless to attempt to raise wheat upon such lands. The opinion that oats exhaust the soil, is an unfounded prejudice; for any system of rotation, with proper management, appears to be beneficial. Those parts, on the other hand, that possess a clay soil, with variable proportions of sand, admit of the alternate extraction from them, of corn and wheat crops, provided they be followed up by clover, cut and turned in with lime; or if grazed not too closely.

Another popular belief, founded upon prejudice, is, that plaster will not act upon lands continguous to salt water. It is not so. Lands, whether near or remote from the sea, upon which *gypsum* did not seem to take kindly, have been found, *after being marled or limed*, to derive the usual benefits imparted by this valuable material.

In some parts of Somerset, a small portion it is true, as yet, the crop of sweet potatoes is the main one, and is found very profitable, as is evident by the thriving condition of the small farms on big and little Deel's islands, whilst intelligent farmers, in other parts of the country,

have turned their attention advantageously to the cultivation of beans, peas, &c. But there is yet another growth that bids fair to become of greatvalue to the agricultural interest of the Eastern Shore of Maryland, namely, the *palma christi*, or castor bean plant, sometimes known by the name of *mole plant*.

An attempt was made in the Report of last year, to excite the interest of the farmers of Queen Anne and Caroline counties, in behalf of this new crop. It is to be regretted that they have not extensively, if at all, availed themselves of the suggestion—the bean having increased in value far beyond the most sanguine anticipations. There ought to be, therefore, no further delay to the introduction of this growth, as one of the staple commodities of Maryland. Without having been as yet able to ascertain the precise cause of the extraordinary demand for this article, within a few years, there is still reason to believe that the call for it will continue to be great; since, notwithstanding its extended cultivation in consequence of the high prices obtained in preceding years, it now commands a higher price than at any other former period. It has been stated that the oil expressed from the beams is employed in large quantity in the manufactories of England for greasing the machinery by which these establishments are put into operation.

The culture of the palma christi presents no difficulties. It is said to thrive best in good corn lands, yielding, according to the quality of the soil, from twenty-five to forty bushels per acre. The land requires the same preparation as for corn; and the bean is planted like this grain—in hills on which two or three plants are suffered to grow; the subsequent tillage being also the same as that practised for corn. The most tedious part of the management of this crop is the gathering of the fruit, which forms a cluster with a pyramidal termination; the lower portion being occupied by the male flowers that yield no seed, and the upper by the female flowers. In the female flowers, the ovary, which is roundish and three-sided, supports three linear reddish stigmas, forked at their apex. The fruit, properly speaking, is a round capsule, with three projecting sides, covered with rough spines, and divided into three cells, each containing one seed. The flowers appear in July, and the seed ripens throughout August and September.

If suffered to do so on the plant, the capsule bursts with considerable force, projecting the seed at a distance, and scattering it about the field. To avoid this is the only extra attention required by this growth, and this is done by anticipating the maturity of the fruit. The directions are: to visit the plantation a little before the commencement of the ripening season, removing those clusters that approach to maturity, (which is known by a change of color, from grayish green to a light pea green,) and conveying them to the drying ground, where, by the effect of the sun's heat, they burst, and dislodge their seeds. The only preparation for the drying ground is to provide a small place, cleaned and levelled as for a threshing-floor, upon which the clusters are scattered. It would be advisable to locate this spot in the neighborhood of the barn, or near a shed, so as to facilitate the removal of the plants, in case of protracted wet weather, to some sheltered situation. Transient showers of rain do not, however, damage it, otherwise than by blackening the seed, whereby its sale might be injured, although it does not diminish its productiveness in oil. The occupation of gathering having once commenced, it should be so arranged as to visit each plant twice a week, morning and evening, until the whole crop has been secured. It may then be sent to a market, where, at the time of writing this Report, it commands three dollars a bushel; or, it may be made to yield its oil by the following process, as practised in Northampton county, Virginia.

The seeds are first to be thoroughly cleaned of dust, and of portions of the capsules that may have adhered to them. They are then introduced into shallow iron drawers, arranged on both sides of a furnace, where they are exposed to a gentle heat; the object of this first operation being to render the oil more easy of expression. From these drawers they are conveyed into a powerful screw-press, by the operation of which the oil is obtained. So far, however, the oil is impure: it must now, therefore, be transferred to clean iron boilers, previously supplied with water. As the boiling proceeds, the impurities that rise to the surface are skimmed off, and the clear purified oil finally makes its appearance, floating on the water. It is now carefully removed, and a second time subjected to the boiling process, with a very small quantity of water, until the latter liquid has been entire-

ly dissipated. This is ascertained by taking out a small portion into a vial, and observing whether it preserves its transparency as it cools. Some care is required not to push the heat too far, as then the oil would acquire a brownish hue and a hot peppery taste, which would at all events unfit it for use as a medicine. One bushel of seeds yields about one gallon and three quarters of oil, at an expense of about 25 cents a bushel, which is refunded by the sale of the *pumice*, found to be an excellent manure for corn crops. Acknowledgments are due to Mr. Smith, of Northampton county, Va. an intelligent and experienced planter of palma christi, and manufacturer of castor oil, in the vicinity of Eastville, for the information contained in the above paragraphs.

It is needless after what has just been said, to expatiate upon the value of this plant. That the soil and climate of at least the lower portions of the Eastern Shore of Maryland are congenial to its growth, cannot be doubted. The praiseworthy example (crowned, it is believed, with entire success) has already been set to the inhabitants of Somerset, by one of the most intelligent farmers of the county—Col. Arnold E. Jones.

Persons well acquainted with the cultivation of rice confidently assert and believe, that there are many spots on the Eastern Shore of Maryland, well calculated to the production of this important agricultural commodity. Rice has been raised in Maryland, in the vicinity of Salisbury, at the head of the Wicomico, and a promising attempt, the result of which has not been ascertained, was recently being made opposite Vienna, on the Nanticoke. It would seem desirable to encourage such attempts, as further conducive to the practical illustration of the possibility of reclaiming a vast body of lands at present of little value. These are the marshes and cripples that occur on the margin of the large rivers on the Eastern Shore of Maryland. An examination of the actual condition of these marshes justifies the belief that they might, to a certain extent, be drained; whether sufficiently to be made permanently arable, or only to the extent of serving as more firm and safe pasturages, remains to be tried It is thought that the single operation, though one not unattended with difficulties, of diverting a part of the course of the river so as to cause it to pass between the marsh and the mainland, would greatly con-

tribute to their drainage. This appears from the fact, that their most elevated parts are those contiguous to the river, inclining moderately towards the firm land, adjoining which the marsh is always found to be the softest, and more liable to a total submersion. By insulating these bodies of land, always more or less miry, and thus establishing a drainage around them, it is possible they might eventually acquire sufficient consistence, without having recourse to embankments, to afford safe and valuable pasture grounds. The cripples seem irreclaimable by any other means than by embankments—an operation deemed practicable by those who have given much attention to the subject, and who represent them as best fitted for the cultivation of rice.

Such are the agricultural resources of the lower counties on the Eastern Shore of Maryland, so far as the productiveness of the soil, and its susceptibility of improvement are concerned. It has already been stated, that the only incidental resource possessed by this section of country, is to be derived from the facilities of obtaining calcareous matter (in which the soil is essentially deficient) from the shell banks, oyster banks, and other sources already referred to. But before any hope can be indulged, that the inhabitants of this portion of the State will avail themselves of these means of bringing their lands into a higher state of cultivation than they seem to have any idea that they are capable of, it is necessary to remove a fatal impression, too generally made, that the lime derived from shells is of but little value. The result of the inquiries made to disprove this opinion, will be given in the next section of this Report.

An error equally fatal prevails among the citizens of Maryland, in reference to the counties that have just been passed in review—that they are as devoid of interest as they have been believed to be of resources It is hoped that the minute, and, at the same time, faithful account given of them; more minute than would otherwise have seemed necessary; will have a tendency to rectify the false judgment so commonly passed upon this portion of our territory, and contribute likewise to cheer those of its inhabitants who have become disheartened at the present aspect of things, and who are too prone to believe that their industry could be better rewarded at a distance. Industry meets with its just reward every where;

but the assertion is safely ventured, that the same amount of enterprize at home, would secure more comfort and happiness, than, under any circumstances, can be expected in a newly settled country, where all that is obtained is at the cost of solid enjoyments. The adventurous merchant and speculator may find a wide field in the "Far West" to satiate, if possible, his thirst for wealth; but the industrious farmer, on the tide waters of the Chesapeake, needs no better patrimony than that which he already possesses. A soil easily cultivated, and very improvable, having the means of improvement at hand; the necessaries, and even luxuries of life in abundance; a temperate and healthful climate; a free and constant intercourse with a large commercial emporium, by means of a water communication reaching to the very door of his granaries; surrounded moreover by intelligent neighbors, and a peaceful and orderly population; such are the advantages of which he can boast, as a set off against those of any other section of our country. It is full time that he should learn to appreciate them himself.

SEC. III. *On the comparative value of shell lime and stone lime.*

The opinion seems to prevail among Maryland farmers of all grades, that the lime obtained by the burning of oyster, or other marine shells, is very far inferior for agricultural purposes to that procured from limestone. Hence some have been induced to give the preference to an article sold as lime, and offered at reduced prices, over a much purer, and even cheaper lime, because obtained from oyster shells; whilst others, beyond the reach of stone lime, and having abundant facilities for procuring shell lime, have neglected the latter altogether as almost worthless. It becomes necessary, therefore, to rectify public opinion as to the precise relative value of the two substances; at least for agricultural purposes. In the absence of direct experiments attention must be turned to the identity in nature, or the difference existing between them, and the conclusion drawn from the general principle, that bodies similarly constituted will, under the same circumstances, produce analogous effects.

In the first place, then, it will be admitted, that lime (by which the chemist understands a definite and invariable compound) is the same, from whatever source it may

be derived; but the lime of commerce is an indefinite and a variable article. The sources whence the latter is usually procured for economical purposes are, where it occurs in combination with a gas, called the carbonic acid gas; because it is found that by the simple application of heat, this gaseous body may be dissipated, leaving the lime, either perfectly pure, or charged with such impurities as the material employed originally contained. The purer the material then, the purer will be the lime. Now the purest of all the compounds of carbonic acid and lime, is that substance called by mineralogists *calcareous spar*, and the variety of lime stones, that approaches this the nearest, is the *alum limestone*. Supposing this to be a perfectly pure carbonate of lime, it has been ascertained that the carbonic acid exists in it in the proportion of 22 to 28 of lime, or 44 to 56; so that every 100 pounds of the carbonate will yield 56 pounds of lime. This is the greatest quantity of pure lime that can be obtained from any limestone.

Next, by a careful analysis of 100 grains of pulverized oyster shells, it has been shown by Professor Rogers, that they contain:

Carbonate of lime, - - -	95.18
Phosphate of lime, - - -	1.88
Silica, - - - -	.40
Water, - - - -	1.62
Insoluble animal matter, - -	.45
Loss, &c. - - - -	.47
	100.

If we attend only to the carbonate of lime, it is seen that 100 grains of an oyster shell contain 95 grains; or 100 pounds of shells will contain 95 pounds (leaving out the fractional numbers) of lime combined with carbonic acid, which, when burnt, will yield 53.4 pounds of lime. Here is the difference in *quantity* of lime furnished by the same weight of the two materials.

What now is the difference in quality? Besides carbonate of lime, the oyster shells have been found to contain *phosphate of lime*, silica, water, and insoluble animal matter, the whole amounting to 4.35 parts in a hundred. But the phosphate is an improvement to it—the fertilizing property of bones being in a great measure ascribed

as much sand as shell lime. But even in this respect the conclusion is not warranted, except perhaps in the case of a purely sandy soil, in which lime *alone* would, it is believed, prove of little service.

An effort was made, in the preceding Report, to bring into more general notice the laudable efforts of some citizens in Kent county, to extend the use of the lime obtained by burning the contents of those extensive accumulations that have now so frequently been alluded to, as occurring in numerous localities upon our tide-waters. The lime derived from this quarter, it has already been said, can be made nearly, if not quite equal, to that obtained from the fresh shells. It is, at all events, very far superior to most of the stone-lime recently introduced amongst the farmers of Maryland, from an adjoining State, and eagerly purchased at a reduced price. The following result of the analysis of a specimen of *stone lime* from the Schuylkill, lately bought by a gentleman of Harford county, at fourteen cents a bushel, will serve to give an idea to what extent the farmer may be deceived in the purchase of articles of which he does not know the nature.

Analysis of a specimen of STONE LIME *from the Schulykill.*

Lime,	49.
Magnesia,	24.
Carbonic acid,	12.
Alumina,	4.
Iron,	1.5
Silica,	.5
Water,	7.
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This article is so impure, that even had it been fully burned, it would have contained only about fifty nine per cent. of lime; and yet many thousands of bushels of it have been purchased by farmers on tide-water, who might have supplied themselves with shell lime of infinitely superior quality, at less than two-thirds of the price. Shell lime of very good quality is burned at Worton point, at the mouth of Fairlee creek, and on the Chester river, in Kent county, which is advertised to be delivered any where within fifty miles at nine cents per bushel.

No direct experiments are known to have been made that would infirm the conclusion to be drawn from the preceding statements; namely, that for agricultural purposes, there is scarcely an appreciable difference, weight for weight, between shell lime and stone lime of the best qualities. Whilst, on the contrary, it is not at all improbable, that if any economical way could be devised of reducing the recent shells to powder, as effectually by mechanical means as by burning, they would be found, in consequence of presence of the phosporic acid, to possess superior efficacy in the soil to the best alum lime. At at all events, enough is known of the nature of oyster shells (and that of the clam is nearly alike) to cause them to be regarded as an abundant source of excellent lime. Any further delay, therefore, on the part of farmers living on the tide waters of the Chesapeake bay, in employing them for the purpose of procuring and applying this essential deficiency in their soils, can only arise from a wilful disregard and neglect of the resources placed within their reach.

SEC. IV. *On the Discovery of Green Sand or "Jersey Marl" in Maryland.*

It has already been stated that *green sand*, or, as it is sometimes called, "Jersey marl," from the circumstance of its having been first applied as marl in New Jersey, occurs in Maryland. The region of country, comprising the geological formation of which this sand forms a member, embraces, so far as opportunities have been had of tracing it, the lower portions of Cecil county, together with nearly the whole of Kent county, on the Eastern Shore, and, crossing the Chesapeake bay, makes its appearance along the Severn, on the Western Shore. The mineralogical characters of the formation designated as the *Ferruginous sand formation*, are very variable, consisting of local and circumscribed deposites of clay, sand and gravel, most of them highly ferruginous, and varying in color from deep red, yellow, gray and green, to black and bluish black. Among these deposites two of them, for present purposes, merit especial attention—that already referred to as the *green sand*, and another which may be designated as a *micaceous black sand.*

The green sand of Maryland, when pure, may be described as a friable aggregate, with particles of a green

color of various shades, yielding readily under the pressure of a knife blade—leaving a distinct and permanent green trace upon paper; forming a paste with water, to which they impart their color, and communicate a peculiar odor, and are essentially composed of silica, alumine, potash, and oxide of iron; the quantity of potash varying from three to ten per cent.

This green sand forms occasionally extensive beds unmixed with any other mineral substance, but containing fossils; or is mixed in various proportions with the ordinary sands and clays belonging to the formation in which it occurs, and is likewise disseminated through the clays and marls of a more recent period. Its analogue in Jersey has been long and largely employed as an agricultural resource, the fertilizing quality which it eminently possesses being doubtless due to the notable proportion of potash that enters into its composition. That it can be employed in Maryland with equal benefits, there is no room to doubt; so that it becomes a matter of importance to establish its relative value, compared with some known article possessed of similar efficacy. Such an article is found in ashes, whose value is aknowledged by all agriculturists, and, when unspent, owe their properties in a great measure, if not solely, to the presence of the same ingredient—namely, potash.

The quantity of saline ingredients contained in ashes, of which carbonate of potash is the chief, varies considerably, according to the species of wood or plant that has been burnt, and from other causes: but generally, that obtained by the farmer in his household, if unleached, may be said to contain scarcely more than ten per cent. of carbonate of potash. If leached for domestic uses, the quantity may have been reduced to three per cent. On the other hand, the ashes obtained from the soap-boilers contain no potash at all, being nothing more than a very impure carbonate of lime.

If it be admitted that unspent ashes owe their fertilizing quality to the presence of carbonate of potash, there is reason to believe that the green sand will prove equally serviceable in proportion to the quantity of potash which it may contain, and its value may be estimated by ascertaining the relative proportion of this ingredient compared with that contained in ashes. With ashes obtained from the soap-boilers it is not comparable, these being, as already stated, nothing more than an impure carbo-

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The intelligent editor of the Farmers' Register, appears inclined to ascribe the fertilizing properties of green sand, or 'Jersey Marl,' to the presence of gypsum, or sulphate of lime: but the material described above contains none; nor are any of its constituents convertible into this substance. Not the slightest trace of sulphate of lime was discovered in the heaps of marl extracted from the pits of New Jersey; and examined in a number of localities; and Professor Rogers states that this mineral was seen by him only in one locality at which the crystals were so minute and few in number as to require the use of a microscope to be discerned. The error appears to arise from confounding the pure green sand with another arenaceous deposite of the same formation, that will be more particularly described presently, enclosing particles of green sand, but characterized by the presence of sulphuret of iron, and in which crystals of sulphate of lime are not unfrequently found.

The experience of thirty years has demonstrated to the farmers of New Jersey, that green sand is both an efficient and prominent manure. Its discovery in Maryland cannot fail to prove equally serviceable to the agricultural interests of this State; but in order to derive full benefit from it, experiments must be made, not to establish its efficacy for that cannot be doubted, but to as-

certain the extent to which it may be employed according to the nature and condition of the soil In the absence of positive results, the safest course is probably to use it in moderate quantity; though nothing is apprehended in applying it to any kind of soil, in the proportion of from five to twenty loads of twenty bushels, to the acre, as in New Jersey, where it is delivered at the pits for thirty-seven and a half cents a load, and is not unfrequently hauled to the distance of twenty miles.

The most interesting deposite of green sand hitherto examined in Maryland, occurs on the farm of Mr. Charles Thomas, at the head of the Sassafras, in Kent county. It extends along the banks of the river, in a most convenient situation for transportation by water, and although covered by a thick stratum of ferruginous sand, it is quite accessible in the ravines that intersect the banks, appearing also at the foot of the hills that spur into the river. In one spot the sand is filled with fragments of fossil shells, (*Terebratulæ*,) by which its value as marl will be found doubtless greatly enhanced. There is reason to believe that, in the hands of its intelligent proprietor, this deposite will not remain neglected; its contents have, indeed, been used already on a small scale, with the promise of the best effects. A similar deposite occurs on the opposite side of the river in Cecil county.

It was thought advisable to obtain specimens of the green sand from the locality just referred to, for distribution among the farmers of Kent county; directing at the same time, their attention to those spots where it was found to make its appearance with the most favorable indications of its occurrence in a sufficiently pure state. This measure, with the assistance of some of the most enterprising and intelligent inhabitants of the county, has been attended with some advantages, by instituting researches among those interested in the discovery, and thus preparing the way for the more thorough examination which it is proposed to make during the ensuing season of this interesting portion of the State.

Another deposite, contemporaneous, it is believed, with the ferruginous sand formation, has been designated as a *micaceous black sand*. Its general characters are the following: Viewed in a mass, it presents the appearance of a bank of bluish black clay, somewhat plastic, and leaving a glossy appearance under the spade; but when ex-

posed to the air it crumbles into a greyish black sand, with minute and numerous spangles of mica, and enclosing particles of green sand. It is readily diffusible in water, in which it remains suspended for some time, imparting to it a bluish black color, and emitting a decided odour of gun-powder. When spread out, and after exposure to the atmosphere for some days, it here and there exhibits an efflorescence of sulphate of iron, arising from the decomposition of nodules of *sulphuret of iron*, which it very generally contains. Crystals and spiculæ of sulphate of lime are also not unfrequently seen, or may be detected by a closer examination. In most locations, impressions only of fossil shells are observed, but in others the fossils themselves occur, though rarely, in a good state of preservation. The best preserved fossil obtained from a deposite of this sand, not yet visited, but of which samples were forwarded, is the *ostrea falcata*. In one locality, at the head of Churn creek, Kent county, the bed having been penetrated into for several feet, was found to contain numerous fossils, consisting of a species of *Turrella*, the *Cucullea vulgaris* of Dr. Morton, claws of crustacea, teeth of a saurian animal, fish bones, wood perforated by marine insects, &c. At another spot on the bay side of the same county, at Fairlee, a bed of this sand presents itself under interesting circumstances; it forms, as it were, a wave extending about one hundred yards along the bank, contains nodules of pyrites, particles of green sand and spiculæ of selenite, and is overlaid by a deposite of gravel enclosing large boulders of primary rocks, mostly hornblend and quartz rock. But a more particular geological account of this deposite is deferred for another occasion.

A closer examination of this micaceous black sand shows it to be constituted principally of a fine siliceous sand, the grains of which are nearly transparent or colorless, small spangles of silvery mica uniformly disseminated, grains of green sand, and finely divided earthy matter; its black color appears to be due to the presence of carbonaceous matter. Fragments of very thin shells, and what would seem to be the tendrils of roots matted together, are also discernible. Sulphates of iron and alum exist already formed in the sand, and may be dissolved out of it by water, which likewise takes up a vegetable extractive matter. Treated with alcohol, a small

to the phosphoric acid, which they contain in combination with lime; the water is driven off as a vapour; so that there remains 85 hundredth of impurities in the form of silica, or sand, and insoluble animal matter. Oyster shell lime differs therefore in *purity* from the alum lime by the 85 hundredths of a pound on every hundred pounds; and this is the precise difference in *quality* between them, supposing the alum limestone to be a perfectly pure carbonate of lime, which is seldom the case. But is the lime thrown into the market for agricultural uses always obtained from pure alum limestone? The following table exhibiting the analyses of ten specimens of limestone from Baltimore, Harford, and Frederick counties, from which the Maryland farmers derive their principal supply, will show that it is not.

Analysis of ten specimens of Limestone, from Baltimore, Harford and Frederick counties.

No.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Carbonic acid	42.	46.	43.	43.	43.5	39.	42.	47.	43.5	41.
Lime - -	54.	30.	55.	55.	55.5	49.	54.	31.	55.5	29.
Magnesia -	"	18.	"	"	"	"	"	18.	"	17.
Silica - -	4.	6.	2.	2.	1.	11.	2.	2.	1.	9.
Undetermined	"	"	"	"	"	1.	2.	2.	"	"
Oxide of iron	"	"	"	"	"	"	"	"	"	4.
	100	100	100	100	100	100	100	100	100	100

It will be perceived that three out of the ten are magnesian limestones; all of them contain more silica or sand than has been found in oyster shells, and one, said to be most extensively used in Harford county, contains as much as eleven per cent. of inert matter. It follows, therefore, that as oyster shells are composed nearly of pure carbonate of lime, they will afford a lime containing scarcely an appreciable quantity of impurities. If well burnt, (which is the case when no effervescence is observed on treating them with a weak acid,) lime obtained from them may be deemed, with a fractional difference, equal weight for weight, to the best stone lime; and as their chemical composition does not vary, there is nothing to be deducted from the value of the product in consequence of the impurities that exist, as exhibited by the foregoing table, in most limestones, and that must necessarily form a part of the residue when *these* are burnt.

If the comparative value of the two products be estimated by measure, a greater difference is discovered; but there is at the same time a disproportionate difference in price. A bushel of the best alum-lime weighs from ninety to a hundred pounds; whereas. the same bulk of shell lime, unground, weighs from sixty-five to seventy-five pounds, and perhaps when ground, would weigh eighty pounds—a difference of from twenty to twenty-five cent. But the former costs from thirty to thirty five cents at Baltimore, the most convenient spot for its delivery on tide-water, where the latter can be had for ten cents; whilst farmers, conveniently situated on the bay side, might themselves burn the shells at an expense not exceeding six cents a bushel. These remarks refer to the lime obtained from recent or fresh oyster shells; but there is little or no difference between it and that procured by the burning of those contained in the Indian shell banks, provided proper care be taken to separate them from the black mould and dirt with which they are mixed.

It has been supposed, that because alum-lime has been found to admit of a greater admixture of sand than shell lime, in the making of mortar, it was to be inferred that it is correspondingly better, or, as it is termed, *stronger* for agricultural purposes. But this is an unwarrantable conclusion; for, as this circumstance seems to depend upon the peculiar aggregation among the particles of the lime, which prevents it from *setting* too rapidly,(or,in other words, attracting water and carbonic acid from the atmosphere sooner than the wants of the mason require,) it would appear, on the contrary, that, if any inference is to be drawn from it, it is adverse to the conclusion; whilst, on the other hand, the fact that shell lime *sets very quickly* is favorable to the opinion, entertained by some persons, of its superior efficacy in agriculture—it being generally understood that lime acts in the soil in the condition of carbonate of lime. Admitting, however, that the peculiar arrangement of the particles in stone lime which renders it in general coarser than the lime obtained from shells, may better fit it as a mechanical amendment to certain soils, the difference is at most as one to three, according to the datum upon which its superiority is predicated; namely, that in the preparation of mortar, stone lime will bear three times

as much sand as shell lime. But even in this respect the conclusion is not warranted, except perhaps in the case of a purely sandy soil, in which lime *alone* would, it is believed, prove of little service.

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posed to the air it crumbles into a greyish black sand, with minute and numerous spangles of mica, and enclosing particles of green sand. It is readily diffusible in water, in which it remains suspended for some time, imparting to it a bluish black color, and emitting a decided odour of gun-powder. When spread out, and after exposure to the atmosphere for some days, it here and there exhibits an efflorescence of sulphate of iron, arising from the decomposition of nodules of *sulphuret of iron*, which it very generally contains. Crystals and spiculæ of sulphate of lime are also not unfrequently seen, or may be detected by a closer examination. In most locations, impressions only of fossil shells are observed, but in others the fossils themselves occur, though rarely, in a good state of preservation. The best preserved fossil obtained from a deposite of this sand, not yet visited, but of which samples were forwarded, is the *ostrea falcata*. In one locality, at the head of Churn creek, Kent county, the bed having been penetrated into for several feet, was found to contain numerous fossils, consisting of a species of *Turrella*, the *Cucullea vulgaris* of Dr. Morton, claws of crustacea, teeth of a saurian animal, fish bones, wood perforated by marine insects, &c. At another spot on the bay side of the same county, at Fairlee, a bed of this sand presents itself under interesting circumstances; it forms, as it were, a wave extending about one hundred yards along the bank, contains nodules of pyrites, particles of green sand and spiculæ of selenite, and is overlaid by a deposite of gravel enclosing large boulders of primary rocks, mostly hornblend and quartz rock. But a more particular geological account of this deposite is deferred for another occasion.

A closer examination of this micaceous black sand shows it to be constituted principally of a fine siliceous sand, the grains of which are nearly transparent or colorless, small spangles of silvery mica uniformly disseminated, grains of green sand, and finely divided earthy matter; its black color appears to be due to the presence of carbonaceous matter. Fragments of very thin shells, and what would seem to be the tendrils of roots matted together, are also discernible. Sulphates of iron and alum exist already formed in the sand, and may be dissolved out of it by water, which likewise takes up a vegetable extractive matter. Treated with alcohol, a small

portion of a resinous substance is separated that may be precipitated by water. A more satisfactory opinion of the true nature of this sand will, however, be formed by a reference to the following elaborate analysis of it, as furnished at the request of the Undersigned by Mr. P. T. Tyson.

Analysis of the micaceous black sand, associated with the green sand, in Maryland.

Silica, - - - -	65.50
Alumina, - - - -	7.75
Protoxide of iron, - - -	11.70
Lime, - - - -	1.40
Potassa, - - - -	.20
Carbonic acid, - - -	1.10
Sulphuric acid, - - -	2.00
Water and volatile matter, -	8.00
Vegetable extractive matter, -	a trace
Resinous matter, - - -	a trace
	97.65

The view thus afforded of the chemical composition of the material now under examination, leads to the belief, that when applied to the soil, such an arrangement of its constituents might be produced as, by the decomposition of the sulphates of iron and alum, and the presence of calcareous matter in the shells which it contains, would give rise to the formation of a sufficient quantity of sulphate of lime, or gypsum, to account for the good effects that have resulted in several instances from its application as a manure. For, supposing its composition to be uniform, the quantity of sulphate of lime that would be formed might be such that thirty-five bushels would contain about the same quantity as one bushel of *ground plaster of Paris*, its fertilizing property enhanced moreover by the presence of oxide of iron, potash, and vegetable matter, and as a bushel of plaster of Paris is the usual quantity applied, it follows that thirty-five bushels of the *black sand*, being equivalent to one bushel of gypsum, might be expected to produce analogous results. It has at all events been used

advantageously as a top dressing on grass crops, and it has proved injurious when employed largely upon corn lands; so that enough of it is already known, to constitute it an object of interest for those farmers who have it within their reach. In the hope of stimulating them to its employment, *experimentally*, the following localities, where this sand has been observed, or whence specimens have been obtained, including those already named, are now indicated.

The *micaceous black sand* has been observed in place—on the Eastern Shore, at the head of Churn creek, on the farm of Mr. R. Jones, who has used it successfully as a top dressing upon clover, and from whom the information was also obtained, that it had proved destructive to the first crop of corn after a copious application; and at Fairlee, on the farm of Richard Frisby, Esq. Specimens have likewise been forwarded from other parts of Kent county, and of Cecil county; but generally accompanied by other parcels, and so indefinitely marked that it might not be advisable to refer to them at present.* It may be stated, however, that the banks of the Bohemia river, in Cecil county, will probably afford an abundant supply of this material; to which the attention of landholders in that section of country, as well as to the occurrence of the green sand, is earnestly solicited. On the Western Shore, the micaceous black sand has been discovered at the head of Severn river, in Anne Arundel county, and on the borders of Round bay. In Prince George's county, it was found in the vicinity of Nottingham, on the estate of R. W. Bowie, Esq. occurring in the deep ravines that intersect the country bordering on the Mattaponi. It contains impressions of shells, and is occasionally covered by a layer of indurated sand with similar impressions. The deposite mentioned in a preceding Report, as occurring at Oxen creek, on the Potomac side of Prince George's county, and then designated as *copperas earth*, is now believed to be analogous to those now under consideration; and the same observation applies to the other deposites of this earth that were at the same time indicated as occurring in Charles county. The *micaceous black sand* has also been seen in St. Mary's county, and will be more par-

*See *Appendix to this Report.*

ticularly referred to in the section embracing a geological account of this county.

On the plantation of Col. Wm. D. Merrick, in Charles county, there occurs a black micaceous sand precisely similar, in its mineralogical characters, to that described above. This deposite makes its appearance in several places on the head branches of Pope creek. It contains fossil bones—the vertebræ, and other portions of animals, belonging, it is believed, to the *saurian* family; and in one locality (Mrs. Edelen's plantation) forms a stratum of from eight to ten feet thick, covering a bed of blue-shell marl. At a greater elevation, in the same vicinity, there occurs a bluish green micaceous sand, with impressions of shells, which seems to occupy a position superincumbent upon the micaceous black-sand; and a similar sand has been observed underlying the fossiliferous deposities of St. Mary's county. The geological relation of these arenaceous deposites with the secondary and tertiary formations of the Atlantic coast, has certainly not, as yet, been satisfactorily determined. Whenever such a determination shall be attempted, it will be found necessary, most probably, to attend to their mineralogical characters, as paramount in importance with the nature of the fossils contained in them, upon which their classification into geological groups has hitherto, it is thought, been too exclusively based.

SEC. V. *Geological examination of St. Mary's county, in reference to its agricultural resources.*

St. Mary's county is longitudinally traversed by a ridge of diluvial gravel and sand, superincumbent upon a fossiliferous deposite belonging to the older pliocene period. This ridge attains its greatest elevation on the Patuxent side of the county, inclining gradually towards the South, and in the direction of the Potomac, until at various distances from it the country falls off in more abrupt slopes towards the flat lands on the river side. Between the ridge and the Patuxent, on the north side of the county, the country is very irregular and uneven; being a succession of short hills, separated by narrow and deep ravines, and spurring towards the river, which they sometimes reach, forming banks of from ten to thirty feet in elevation, but more generally terminating

at a quarter or half a mile from it, leaving an interposed level. The direction of the ridge is north-west and south-east, declining in elevation, as already said, at this latter extremity, and forming an inclined plane of gentle descent towards Point Look out, which terminates the Peninsula.

The soil on the ridge land varies from sandy to sandy loam, rarely stiff, with a growth principally of pine. On the Patuxent side, the hills and valleys are composed alternately of sand and gravel, white and ferruginous clays, forming a soil varying from sandy and clayey to sandy and clayey loam, which, according to circumstances, is very productive in corn, tobacco, wheat and oats. The river flats are generally a stiff clay. On the Potomac side, the soil of the highland is more commonly a sandy loam, the slopes are frequently gravelly, and the levels that are much more extensive on this river than on the Patuxent, are principally deposites of stiff clay, with here and there, towards the foot of the hills, tracts of a lighter soil. These soils that now, with the slightest efforts at improvement, yield good crops of tobacco, corn, and wheat, can, like all those on the tide-water districts of Maryland, be rendered, by the use of calcareous manures, exceedingly productive: and fortunately this means of improvement has been providentially placed within a most convenient reach from an abundant source forming a prominent feature in the geology of the county.

In the Report of the preceding year the fossiliferous deposites constituting what has been termed *shell marl*, were traced almost in an uninterrupted succession along the banks of the Potomac, and on the head-waters of the streams emptying into it, from the Piscatawa to the Wicomico. There was reason to expect, that they would continue to occur, under similar circumstances, beyond the latter river, and this expectation has not been disappointed. The *blue marl*, described in the preceding Report, makes its appearance on the Chaptico, and in the ravines descending from the uplands towards Bedlam neck. It again occurs at the head of St. Clement's bay, and will doubtless be seen wherever natural causes have removed the superincumbent soil, which is generally of considerable depth; or the marl may be discovered by the removal of the soil in favorable situations.

On Britton's bay, at the Papaw hollow, there is an ex-

tensive deposite of fossil shells, reaching from six to ten feet above tide, and a similar bed occurs on the opposite side of the bay, on the plantation of Col. Harris. These alone would furnish an abundant supply of calcareous earth, sufficient to fertilize the whole county, if similar beds did not occur in numerous other localities At the entrance of the bay, on Huggin's Point, nearly at the extreme end of Medley's Neck, a blue marly clay makes its appearance at low water mark, enveloping fossil oysters. In the upper portions of this deposite the calcareous matter of these fossils has almost entirely disappeared, and is replaced by oxide of iron; whilst at a small depth in the same bed, the shells are unaltered,but very soft, and readily disintegrate. This deposite is probably to be referred to the newer pliocene period, and is analogous to a similar one already mentioned as occurring at Cornfield Point, on the Potomac, but lying several feet above tide. It is presumed that this material could likewise be put to good account, which will probably be done by the intelligent gentleman on whose plantation it is found.

From Britton's bay to the St. Mary's river, no fossil deposite has been discovered; but on this river, at Windmill Point, at Pagan Point, and at the mouth of St. Inigo's creek, extensive accumulations of marine shells have long ago been known to exist, but they have not yet been used as marl. It is hoped, however, that the efforts made to demonstrate their value, will have been sufficient to induce their proprietors at least to give them a trial. The *gypseous clay*, mentioned in the first Report of a general geological survey of the State, submitted to your Excellency at the close of the year 1833,which was stated to occur on the St. Mary's, and described as doubtless affording a valuable agricultural resource, has also remained entirely overlooked. The opinion is still entertained that it might be employed with marked benefits, especially upon the lighter soils in its immediate vicinity.

Between the St. Mary's and Point Look-out, only one fossiliferous deposite has been observed, at Cornfield Point; it is a bed of black mud reaching from four to six feet above tide, in which are imbeded a few marine shells, (a large species of *pholas*, and a species of *fusus*, principally) above this there is a layer of oysters and clams from one to three feet thick, the whole covered by a strat-

um of gravel and sand from four to six feet deep. As the shells in this locality are similar to those belonging to testaceous animals that inhabit our Atlantic coast, the deposite is referred, as already stated, to the newest of the tertiary formations. It cannot fail to prove valuable, as a natural bed of manure composed of calcareous and vegetable matters mixed with aluminous particles, all of which would necessarily tend to improve and fertilize the light sandy soil incumbent upon it.

The most extensive deposites of *shell-marl*, however, are found on the Patuxent side of St. Mary's county. In the deep gullies that furrow the country at the heads of the short creeks emptying into this river, the marl scarcely ever fails to make its appearance; and although occurring under disadvantageous circumstances for extraction, ought not for this reason to be neglected, as it would not be difficult to contrive efficient arrangements for its removal upon a convenient place for subsequent distribution. A cheap and simple contrivance for this purpose has already indeed, been devised; as it may prove eminently serviceable to the planters of this portion of the country who are disposed to make a trial of the hitherto neglected resource which they have so near at hand, a figure of it, with some trifling modifications of that furnished to the Farmers' Register, by Wm. Carmichael, Esq. of Queen Anne, is appended to the Report. With such an arrangement, we are informed that "where the *marl* is uncovered, with one efficient hand in the pit,and a less efficient one to discharge the boxes and drive the horse, five hundred bushels may be raised in a day."

The marls now referred to are of the best kind, consisting of beds of a sandy clay—filled with innumerable shells of marine animals, of which the large pearl shells, so called,(*perna maxillata*) are among the most numerous. The proportion of calcareous matter (carbonate of lime) in them is not less than from fifty to sixty per cent. so that they would doubtless prove a beneficial application to any of the soils on the Patuxent, and in employing them, the general directions which were given in the Report of the preceding year might be followed—namely, if the soil is already under a good course of cultivation, from three to five hundred bushels to the acre may be used safely and profitably. But it is hazardous to go beyond this quantity, especially in corn lands; although

it has been found that the succeeding wheat crop is improved, and that the land recovers in a few years from such an overdosage. On new lands naturally well constituted, and containing much vegetable matter, there can be no risk in using the full quantity of five hundred bushels, or even more. Whilst on light sandy soils, or stiff clay soils, unimproved, three hundred bushels will be found sufficient, until the soil has been brought into a good state of tillage, when an additional quantity may be applied. It is always proper, of course, to select, as far as practicable, a clayey marl for a sandy soil, and a more sandy marl for a stiff soil.

It has already been said that a deposite of fossils forms the substratum of the portion of county now under examination from Indian creek to Town creek, so that the marl will probably be found in all the deep ravines that intersect it. But they frequently occur in a more accessible position. Thus on approaching the river, the hills diminish in size, and form a line of isolated knolls, on the flanks of which, in several instances, beds of marine shells were observed of the same kind as those in the blue sandy clay of the ravines. These hills are composed sometimes of gravel and sometimes of sand, and the latter present most ordinarily a bed of fossils. When they reach the river shore, so as to constitute its banks, sections of these hills are thus presented exhibiting their internal structure, and under these circumstances, almost invariably show that they are principally composed of shells and other marine productions. Some of the banks of the river, in this way, exhibit a continuous deposite of shells, of a considerable extent, with an average elevation of twenty feet, and yield an abundant and easily obtained supply of marl. Such is the character of the river banks between Cole's and Thomas' creeks, as also, between Cat creek and Sotterly point.

These beds of marl rest on a greenish sandy clay, containing impressions of shells of the same kind as those in the marl, and where the impressions are most numerous the sand has become indurated so as to form a hard rock. At other places, the bank is composed of this greenish sand, rising from five to fifteen feet above tide, with only a few impressions, and imperfect casts, of undetermined shells. A deposite of this sand occurs on the plantation of Mr. George Thomas, on the Patuxent;

another was observed near Leonard-town, on Britton's bay, and your Excellency will recollect that a bed of sand bearing similar characters, was pointed out by the Undersigned on your own estate, at Notley-Hall, on the Wicomico. It has been met with elsewhere; and as its position—underlying the shell marl, properly speaking—is important in directing the research that may be made for this latter material, independent of geological considerations, it may not be amiss to call the attention of those who take an interest in the subject, to the relation which it thus seems to bear to the more valuable article usually found above it. Whether, moreover, it may not itself prove of some value is yet to be ascertained. For the purpose however, of determining in a more satisfactory manner the precise relative position of this greenish sandy clay, with the fossil deposites constituting what has been termed *shell marl*, an excursion was made to the Nominy cliffs on the Virginia shore of the Potomac, where, from the condition of these elevated banks, it was expected some interesting geological facts might be displayed. These cliffs, that are upwards of a hundred feet high, accordingly, exhibit at their base the same greenish sand, enveloping fossil bones, and covered by a fossiliferous stratum of the same character as the marl beds on Britton's bay and the Patuxent, and above all a thick layer of sand, gravel and soil.

Near the mouth of the Patuxent, at the Millstone landing, the river bank has an elevation of about thirty feet, its upper portion consisting of a sandy loam, containing fragments of fossil oyster shells, and resting upon a stiff clay, through which are disseminated crystals and crystalline masses of sulphate of lime, similiar to those indicated as occurring on the St. Mary's river. This *gypsous clay* would no doubt prove a valuable addition to its superincumbent soil.

On the Potomac side of the county, at the head of Herring creek, a micaceous black sand was observed, answering in every respect of mineralogical characters to that found associated with the green sand of Kent county, on the Eastern Shore of Maryland, and also, as previously described, with the blue marls of Charles county; but the limited portions of this bed which it was practicable to examine, did not exhibit any fossil re-

mains. The occurrence of such a deposite in this situation had attracted the attention of the Undersigned, as well as that of the gentlemen who accompanied him in his first geological excursion through the State in 1833, and they had then agreed to refer it by its physical character of resemblance to what they then designated by the name of *copperas earth*, without attaching any particular importance to it; but a closer examination having shown it to be so intimately allied in its *chemical* nature with the micaceous sands of the secondary period, it is believed to have hence acquired an additional degree of interest in a *geological* point of view; an interest which the Undersigned will not fail to carry out according to his means and opportunities, in his ulterior researches. As an agricultural resource, if the views that were taken in the preceding section are correct, it will perhaps be thought worth the trouble of a trial.

It has been affirmed that the fossiliferous deposites described above, extend under nearly the whole of the peninsula lying between the Patuxent and the Potomac. Accordingly, even in its most central portions, wherever natural occurrences, as the force of a running stream, have removed the incumbent soil, beds of shell-marl make their appearance. Thus at the very head of one of the tributaries of the Wicomico, on the plantation of Col. Wm. Matthews, in Charles county, an extensive bed of very excellent blue marl occurs. And again, on the head waters of the Chaptico, in St. Mary's county, on the farm of Mr. P. Briscoe, a deposite of marine shells has likewise been found; but in this position the shells are agglutinated together by a silicious cement, though they appear to have been originally enveloped by a sandy clay of a greenish blue color. The marl here occurs, therefore, in large indurated masses, that are capable of being broken with no very great difficulty when first raised from the deposite, but afterwards harden by exposure to the air: it may perhaps be the surface portion of a more friable, and hence more valuable bed, lying at a greater depth. The occurrence of marl in these central portions of the peninsula, at the same time that it warrants the assertion that this material forms the substratum of the country, affords an inducement to search for it, at least in favorable situations; such as present themselves in the gullies at the head of the streams that

empty into the alluvial bottoms, or *Freshes*, as they are here termed, of Charles and St. Mary's counties.

But, besides the marl, St. Mary's county, like all the other districts of the State on the tide-waters of the Chesapeake bay, possesses another source of calcareous manure, in the Indian shell banks, so accessible and so valuable, that it would be unpardonable to neglect them. These banks occur among other situations at the mouth of Indian creek, on the plantation of Major Sothoron, where their contents are now being used, and at other places, on the Patuxent, they have already been employed to great advantage. They are also found on the Potomac, in Bedlan neck, and on Blackistone's island, the north west extremity of which is covered by an extensive bank of these shells.

It thus appears that the county is particularly favored in the occurrence within its own limits of an abundant supply of what *alone*, if even carelessy applied, is calculated to render its soil as productive as can reasonably be desired. If to this be added the advantages of a geographical position unequalled, perhaps, in the world—a peninsula situation of great beauty, under a temperate climate, and possessed of a soil yielding a great variety of valuable products—tobacco, corn, wheat, oats, cotton, &c.—that may be sent by a short and safe navigation to a choice of markets; there can be seen no other impediment to its unbounded prosperity, but the indifference of its inhabitants to employ the resources which they have at their command. The opinion so generally entertained that the country is unhealty, is unfounded excepting as regards certain spots. It appears to be the fact, although it may be difficult to assign a good reason for it, that the more elevated situations on, and at a short distance from the rivers, are exposed to the cause that produces autumal fevers; whilst those on their low banks are remarkably healthy, and afford beautiful sites for delightful residences. The inland portions of the country, here called the Forrest, are likewise found to be entirely free of malaria. Having travarsed the country at that period of the year when it is reputed to be most unhealthy, the Undersigned feels authorised to state that he saw, or heaad of, but very little sickness, and most of what he did see was probably due to unnecessary exposure.

SECT. VI. *Progress of the Geological Survey of the State.*

By referring to the Report of the preceding year in connection with the account so far furnished to your Excellency in this, it will be seen that the survey of the State, made to this period, embraces on the Eastern Shore of Marylaud, all the counties south of Chester river, together with some preparatory examinations commenced in Kent county; and it may be here further stated, that as the contemplated Map of the State will necessarily comprise the two Eastern Shore counties in Virginia, forming the extremity of the peninsula, it was thought advisable to extend the examinations over these counties also, with a view of ascertaining, by actual observation, the suspected uniformity in the operation of the physical causes that have produced the geological features of this whole section of country, between the Chesapeake and the Ocean. Should the Legislature of Delaware think proper to order a survey of that state, similar to the one which Maryland is now pursuing, a full account of the geology of the great peninsula lying between our bay and the Delaware might thus be obtained, that could not fail to prove of great interest to science. Your Excellency will permit the Undersigned likewise to make, in this place, due acknowledgement of attentions and civilities received by him from Thomas R. Joynes, Esq of Accomac, and John Eyre, Esq. of Eyre Hall, citizens of a neighboring State, who have facilitated the means of obtaining every desirable information with greatest liberality, and have moreover extended to him that generous hospitality so eminently the characteristic of the people of Virginia.

On the Western Shore of Maryland, the surveys comprahend the banks of the Potomac, from the Eastern Branch to Point Lookout, comprising a portion of Prince George's, nearly the whole of Charles county, and with the the examinations on the Patuxent, the greatest portion of St. Mary's county; besides partial examinations of several spots in Prince George's Anne Arundel, and Harford, referred to in this or the preceding Report.

It will thus appear that twelve out of the nineteen counties of the State have been visited, six of which have been thoroughly examined, as far at least as the purposes of the survey appear to require; two are nearly completed; and in the four remaining, examinations

that will tend to facilitate ulterior researches have been commenced.

To answer inquiries made from various quarters, and also to remove misapprehensions, as to the duties of the geologist, it may now be stated, that the plan of operations for the ensuing season, pursuant to the provisions of the bill ordering the survey, is to continue the examination of the districts on tide-water, which it is hoped to complete by the end of the next year. Could the Undersigned do otherwise than execute literally, and in so far faithfully, the commission entrusted to him, it would give him infinite pleasure to obey calls made for his services in many places where objects of acknowledged interest occur, and mineral resources appear, that would require to be speedily developed; but it is evident that he cannot take upon himself to swerve from the line of his prescribed duty, unless on the occasion of some great public advantage to be derived thereby, or when the irregularity cannot be the cause of any serious delay. For the purpose, however, of diffusing the benefits anticipated from the survey, and even of gratifying the curiosity of those situated at a distance who believe that they are in possession of objects of value, a public announcement was made that the Undersigned would willingly examine, when not in the field, any specimens of minerals, ores, marls, soils, &c. that should be forwarded to him from any part within the limits of the State; and in his absence, directions were given to address the specimens to M. M. Tyson and Fisher, at Baltimore—Mr. Tyson, a gentleman fully conversant with the subject, an experienced chemist and mineralogist, having been employed by the Undersigned to communicate any necessary and immediate information that might be required. On this invitation numerous applications have been made, none of which have been wilfully neglected, and the communications relating to them have received as prompt a reply as their nature would allow. The result of some examinations recently, or from time to time, made, and that have not yet been communicated, will be inserted in an Appendix to the present Report.

Next, in reference to the *State cabinet*, the Undersigned has to report, that he has continued to deposite in it the specimens illustrating the geology of the counties that have been traversed, together with such objects as

have been received from other parts of the State, and were deemed to possess any interest. But he has not yet found leisure to supply, as required by a resolution of the Legislature, the duplicate collections intended to be furnished to the several Colleges and Academies of the State. The intention of this resolution will, it is believed, be better satisfied, by postponing the distribution until the completion of his operations, when entire sets of specimens can be furnished, more apt to excite interest, and consequently more likely to be preserved, than when received in small and detached parcels.

In conclusion, the Undersigned cannot conceal from your Excellency that he views with pleasure and pride the probable completion of a work, the projection of which does honor to the State. It is gratifying to find, that wherever he directs his steps, the project meets with the unqualified approbation of his fellow-citizens; and it is no less pleasing to discover that it is approved of by the intelligent abroad as well as at home. Although Maryland has not been the first State to order a geological survey of its territory, it is probably owing to the comprehensiveness of the plan which was first adopted here, and the popular character that it was made to assume in its origin by our Legislature, more than to any previous example, that attention has been directed so generally, of late, towards this mode of developing the resources of a country. Since the commencement of our operations, the States of Virginia, New Jersey, and Connecticut, have ordered and commenced surveys of their respective territory, and the strongest recommendations to institute similar operations in Pennsylvania, Ohio, and New York have been submitted to the Legislatures of these States by their executive officers. Other States will, ere long, doubtless perceive the benefits to be derived from a similar course, and each may be expected to flourish, in proportion as it will afford to its inhabitants the necessary information enabling them to take advantage of the resources that occur within their reach.

But if it be gratifying to know that we have planned well, it would be still more grateful were we permitted to believe that we have executed well. The Undersigned believes that some good has resulted from the researches which he was directed to make:—They have been the means of creating new incentives to industry

by pointing out facilities, and indicating resources, that were not previously known to exist; they have elicited enquiry concerning the nature and value of things hitherto neglected; they have enabled the citizens of Maryland to form a better estimate of the value of their possessions, and may have in this way contributed to render them more attached to their native soil; whilst, at the same time, by furnishing a detailed account of the physical geography of the State, exhibiting its natural susceptibilities, they may be expected to invite foreigners to partake of its advantages. These happy results are already beginning to manifest themselves; and the Undersigned has accordingly seen, with deep interest, that inquiries have been made from abroad evincing at least a more correct impression as to the character and resources of certain portions of the State than had been previously formed. The value of property has thus already been enhanced, and must continue to increase with the prosperity and population of the State, whose political importance must, necessarily, likewise be augmented.

The Undersigned, therefore, has solely to regret that his abilities may not prove equal to the task of developing in their best light all the resources and advantages possessed by the State. He feels confident, only as regards the earnestness of purpose with which he has pursued his investigations, desirous of leaving nothing undone to render them as widely beneficial as possible, relying upon the liberality of his fellow-citizens and that of the government which they have instituted, to enable him to complete with some credit to himself, with much greater good, it is believed, to them, a work that has already given some promise of usefulness.

It is but justice to add, that whatever zeal the Undersigned had brought to the performance of the duties assigned to him, it has been greatly increased by the interest which your Excellency and your Honorable Council have manifested in the success of his operations. If there were not other motives, this alone would have inspired him with those sentiments of profound respect, with which he how has the honor to subscribe himself

Your Excellency's

Most obedient servant,

J. T. DUCATEL.

Baltimore, Dec. 29, 1835.

APPENDIX.

A portion of the duties assigned to the Geologist will be found expressed in the following clause of the bill:—"It shall further be his duty at those seasons not suited to the active prosecution of the geological survey, to analyze and ascertain the qualities and properties of all specimens of mineral substances or soil, left at his office or residence for that purpose, by any citizen of the State, and taken from any portion of the territory of the State."

It has already been said, that in the pursuance of this duty, it was thought advisable to make a public announcement of the appointment of the Geologist, indicating at the same time the most convenient mode of making applications to him. For the further purpose of affording an opportunity to his fellow citizens, residing in the more remote sections of the State, to have their inquiries satisfied with as little delay as possible, they were directed to forward their specimens to Mr. P. T. Tyson, in Baltimore, who had been employed to make the necessary examinations, and communicate all desirable information during the absence of the Geologist. This measure, as a matter of course, has elicited numerous applications, most of which have already been satisfied. Some remain to be replied to, and the present form of communicating the results that have been obtained, is adopted as the most convenient for all parties. Should any have been omitted, as from the multiplicity of the demands is possible, those interested in them are requested to renew their applications; although many are not alluded to, because they have presented no consideration of any interest whatever.

In the tabular view of the analyses of marls appended to the Report of the preceding year, a few inserted in it had not their composition extended, because it had not yet been fully ascertained. The constituents of these marls are now stated, together with those of some others that have been forwarded and examined in the course of the past year.

Analyses of Marls.

Locality.	Silica.	Alumine.	Carbonate of Lime.	Potash.	Iron.	Owner's name, with remarks.
Talbot county.	50 . 00	4 . 20	40 . 00	"	2 . 00	H. Spencer.
"	56 . 00	3 . 50	37 . 00	"	2 . 50	J. M. Chamberlain.
"	50 . 00	4 . 00	41 . 00	"	3 . 00	Wm. Trippe.
"	50 . 00	3 . 00	42 . 00	"	4 . 00	Do. (brown colour.)
Queen Anne county.	43 . 00	4 . 25	50 . 00	"	"	Wm. Bordley.
"	63 . 00	15 . 00	15 . 00	"	3 . 00	Do.*
"	50 . 00	5 . 25	40 . 00	"	4 . 25	No. 1, Wm. Carmichael.
"	45 . 00	5 . 00	50 . 00	"	4 . 00	2, do.
Prince George's co.	58 . 25	8 . 00	21 . 90	2 . 00	3 . 00	Wm. L. Marbury.

* This marl is said to have proved injurious to the soil; but there is nothing in its composition that can account for this, excepting the amount of silica which it contains, if applied to a soil already very sandy. It is a weak marl.

Examination of Specimens from Kent County.

From Mr. Charles Thomas, head of Sassafras.—No. 1 green sand with fossil shells, mixed with about 35 per cent of silicious sand; quantity of potash about 5 per cent. colour light green. 2. Contains about 70 per cent. of green sand, no fossill shells, colour olive green. 3. Dark brown clay, containing sulphates of alumine and iron, and vegetable matter. 4. Clay applicable to the manufacture of bricks. 5. Red ochre, equal in quality to *Venitian red.* This article might possibly be introduced into commerce as a valuable pigment.

From Mr. W. H. P. Worrell, Shrewsbury:—Specimen containing about 50 per cent. of green sand, No. 1.

From Mr. Levi Wroth, Worton.—Specimen No. 2 of an olive colour, contains about 50 per cent. No. 3. Yellowish red sand with particles of green sand.

From Mr. Rasin.—Micaceous sand containing small fragments of fossil bones.

Boon's Land, Sassafras River.—No. 1 contains about 50 per cent. of green sand, specimen of a dull green color. No. 2. *Micaceous black sand,* as described in the Report.

From Mr. James P. Gale—Silicious sand containing about 5 per cent. of green sand.

From Uri's Mills, head of Morgan's creek.—Silicious sand, stained yellow by peroxide of iron, and containing about 15 per cent. of green sand.

From Miss Pearce's farm, head of Chestvr. Micaceous black sand, with impressions of shells, but no green paticles.

From Mr Merritt's Farm, on Chester River.—Finely comminuted shells, and gravel slightly agglutinated. The carbonate of lime nearly 60 per cent. This specimen can scarcely be considered as a fair sample of the bank whence it is derived, as it contains more than the average quantity of carbonate of lime that would be yielded by the whole deposite, which oftener presents an agglutinated mass of sand, cemented by oxide of iron, and containing the impressions only of shells.

Examination of Specimens from Prince Georges County.

From the estate of R. W. Bowie, near Nottingham—No. 1, from the road side, contains about 20 per cent. dark coloured green sand, clay, and spangles of mica. 2. *Micaceous black sand,* with about 5 per cent of green sand; colour of the moss greyish black, with seems of ferruginous yellow clay. 3. Micaceous black sand containing impressions of shells.

Charels County.

From Dr. Neal.—Specimens of micaceous black sand, containing 10 per cent of green sand.

Description of Carmichael's machine for raising marl.

The plate accompanying has been designed to show an arrangement for lifting marl from the pits, now in use by Mr. Wm. Carmichael, of Queen Anne's county, Md.

Fig. 1. is an upright view of the central frame work of the machine, in which AB is the ground sill: OF and AD respectively, the forward and after standards. The forward standard is raised higher than the after one, and receives on a cap the rafter DH; in the prolonged end of which works the axis of the crane. Both of the standards are supported (as in Fig. 3) by sills and braces; the proportions of which, as given in the figure, are, within certain limits, liable to modifications to suit particular convenience.

In the centre C is a capstan, with a lever P that may be worked by human or horse power; fastened to any portion of the barrel by one end, a rope (or chain, which Mr. Carmichael has already found to be the cheaper) passes over the roller, near M (whose object is chiefly change of direction) and thence through the blocks W and X, that may be single or double. To the lower block is affixed the loaded box, having a hinge at the bottom or side; the revolution of the capstan winds of course the chain round the barrel, and gradually shortens the distance between W and X. To per the descent of the box, the lever P is merely pulled out of the capstan head; without moving the horse or running the risk of the revolution of so long a lever.

In our figure of the capstan, the length of the lever is about 16 times the diameter of the revolving axis: 1 pound then at P will balance eight at W. If the blocks W and X be single, one pound in the direction WX balances a weight of two pounds at X—if they be double, it will balance four pounds. We have in the one case, a force at P of one pound equivalent to a weight of sixteen pounds—in the other of thirty-two pounds. The power which a horse can exert being 125 pounds, we have $16 \times 125 = 2000$ as the weight which a horse can raise moving at the at the rate of three miles per hour for six hours a day. The depth of the pit being so very small, there is no occasion, however, to take the velocity of the horse into calculation.

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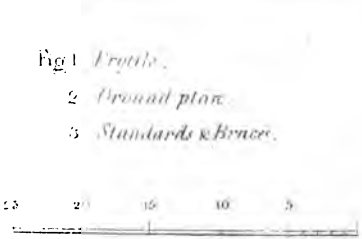
Fig 1 *Profile.*
2 *Ground plan.*
3 *Standards & Brace.*



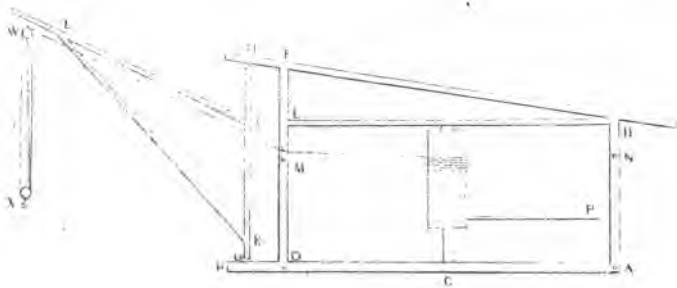


Fig 1

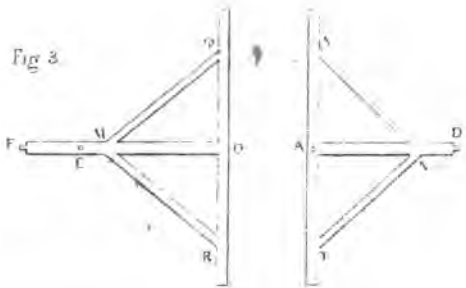


Fig 3

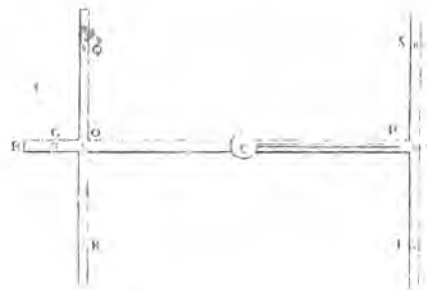
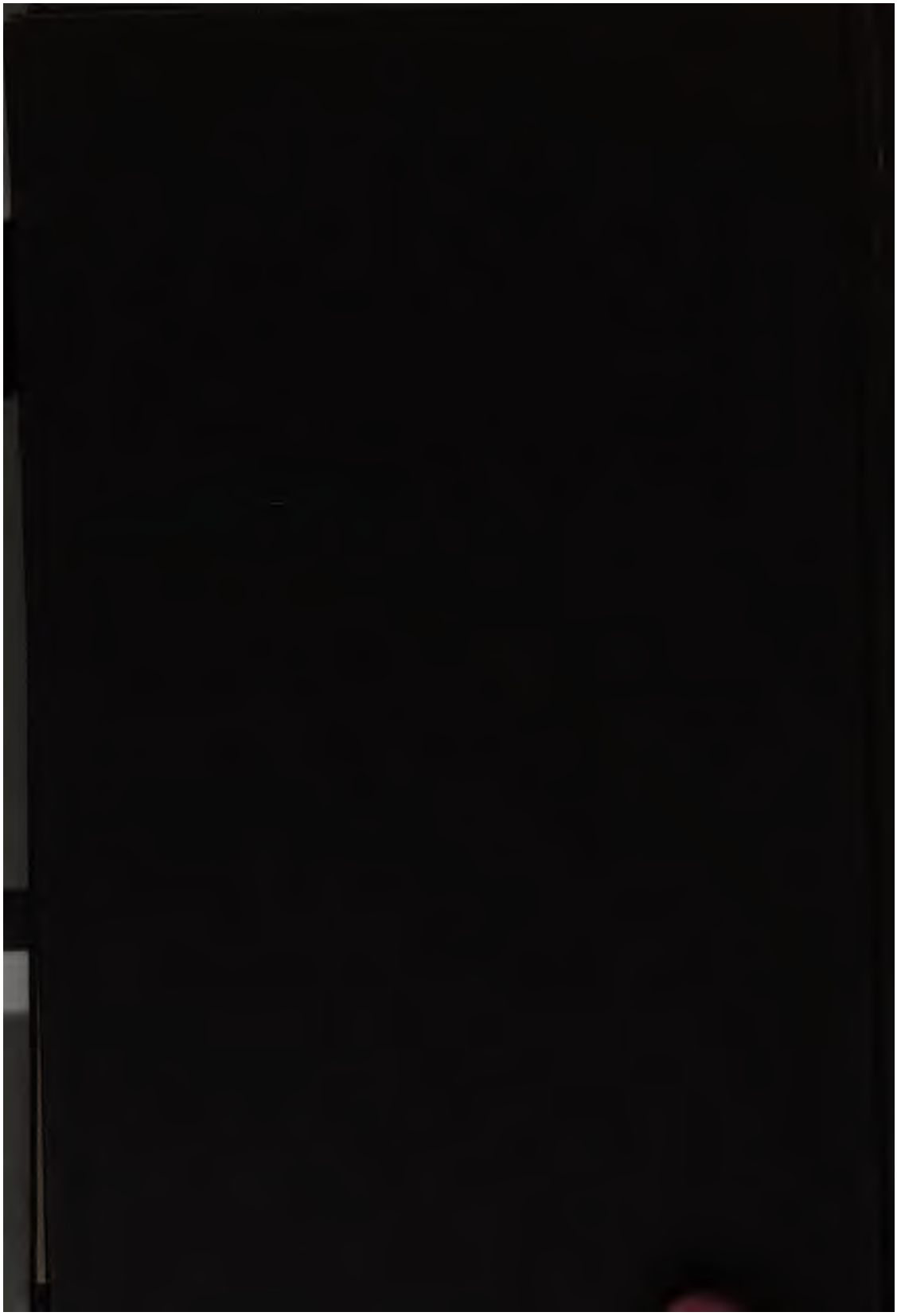



Fig 2